UME XVII OCTOBER, 1917 NUMBER 6

THE AMERICAN MUSEUM JOURNAL

CROCKER LAND EXPEDITION HOME AND
OUR NATIONAL COLORS IN THE ARCTIC
OSTRICH FARMING —— EXTINCT GIANT BIRD
WHALING SOUTH OF THE EQUATOR

50 A YEAR 20 CENTS A COPY

The American Museum of Natural History

CONTENTS FOR OCTOBER

MARY CYNTHIA DICKERSON, *Editor*

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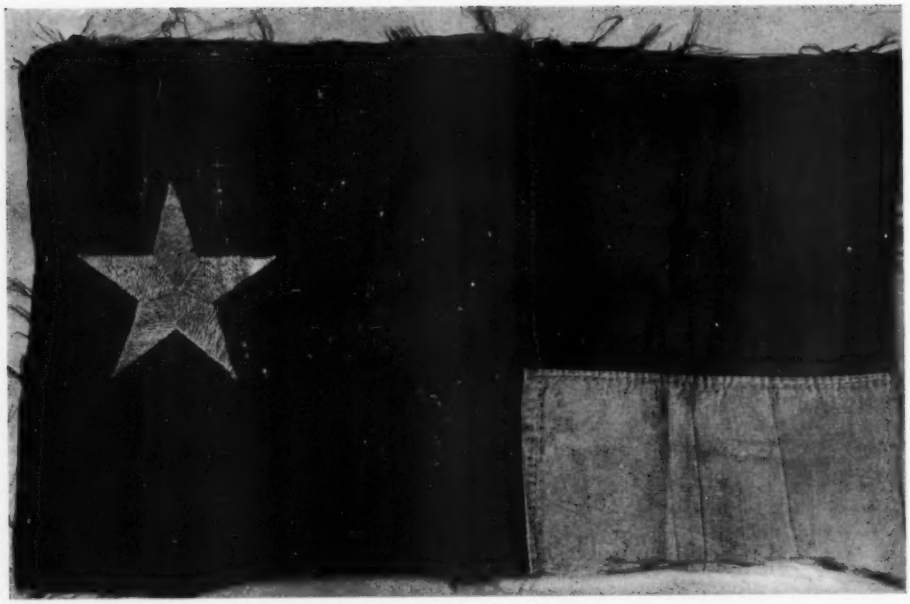

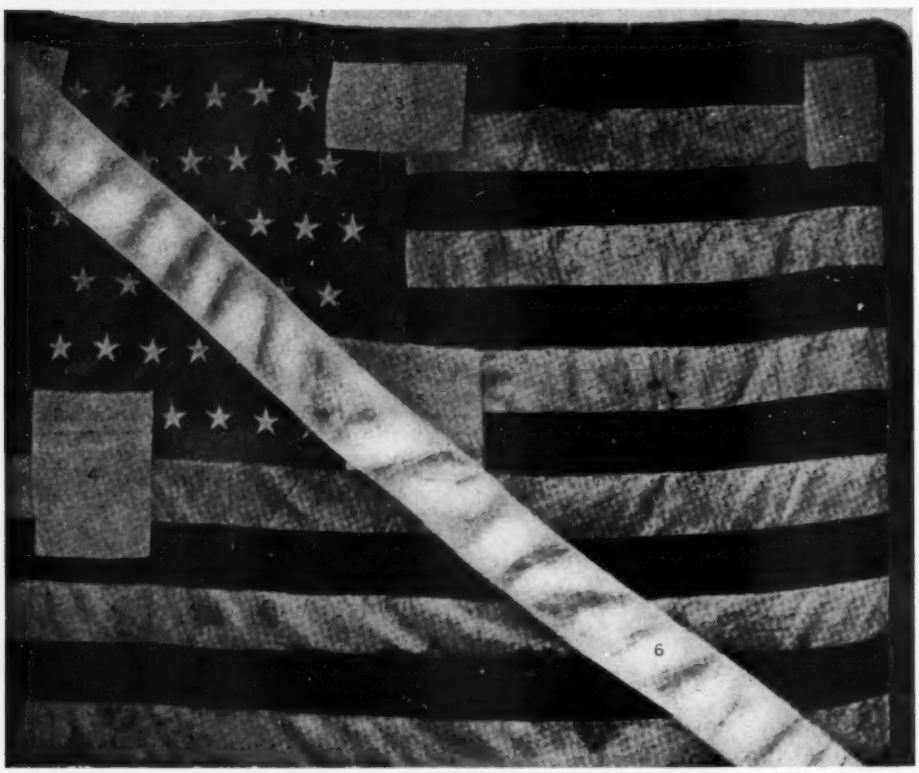

FRAGMENT OF HISTORICAL AMERICAN FLAG

This portion of an American flag (above) was found by the Crocker Land Expedition in a cairn on the highest of the three summits at Cape Thomas Hubbard, in the Arctic, and is now on view at the American Museum. In these days when Americans feel a quick patriotism at sight of the flag, we can well appreciate the thrill that came to the leader of the Crocker Land Expedition when he found the red, white, and blue with its one embroidered star in the distant north.

This silk flag (below), now in the United States National Capital, was made for Admiral Peary by his wife and carried on the expedition which reached the North Pole. Peary cached portions cut from it at different "farthest north" places: Nos. 1 and 2 at Cape Morris Jesup, 3 at Cape Thomas Hubbard, 4 at Cape Columbia, 5 at Peary's "Farthest North" at 87° 6′, and 6, the long diagonal strip, on the ice at the North Pole. The portion brought back by the Crocker Land Expedition is No. 3, from the upper middle section; a complete American flag was left in its place

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The Crocker Land Expedition Home[1]

FROM the dangers and difficulties of exploration in the Far North, Providence has granted a safe return to Donald B. MacMillan, leader of the Crocker Land Expedition, and to all the members of his expedition, as well as to all members of the relief parties sent out during the last two years. As the world bade these men a sympathetic Godspeed four years ago, it now gives them a warm welcome. Their safe return, expertly piloted home by Captain Robert A. Bartlett, with the loss of not a single man and with the great measure of success attained in geographical, geological, and zoölogical discovery, is a matter for rejoicing to all interested in polar exploration. It stands for the triumph of the intellect of man in the contest with opposing physical forces—with bitter cold, and storm, and the long Arctic night.

It is a cause for congratulation to the American Museum of Natural History, the American Geographical Society, and the University of Illinois, organizations which sent the expedition out and have borne the two burdens always incumbent on the organizers and supporters of exploration work in Arctic or Antarctic, namely, continual fear for the safety of the men, and financial backing for whatever may come, unexpected events and delays which may mean wreck to the ships and disaster or death to the men, while prolonging the years of residence in the North far beyond that planned for. As chairman of the Crocker Land Committee, representative of the three organizations supporting the expedition, I can congratulate the members of that body on their unswerving faithfulness to the work devolving upon them.

The Crocker Land Party left in 1913. At the end of two years it had accomplished the intensive scientific work planned and the main exploratory journey of 152 miles northwest from Cape Thomas Hubbard, a hazardous expedition over the moving sea ice, in search of the land which had been prophesied to lie there. The two years since that time, enforced upon the members of the expedition by ice conditions which kept the relief ships of 1915 and 1916 from reaching them, have added vastly to the total results of the work. Especially valuable is the geographical work accomplished on the expedition to Finlay Land and North Cornwall, and in mapping the western coast of Ellesmere Land from Cape Sabine to Clarence Head. The news of the richness of the fauna of large food animals in this uninhabited part of our globe is of unusual interest at a time when study of food conservation is in everyone's mind; and in view of the fact that our fuel resources are being dangerously reduced, we can foresee that the future will, by some method, make available the enormous veins of coal discovered throughout Axel Heiberg Land and the eastern of the Parry Islands.

Aside from the scientific results, there is added much of human interest in the pleasant and helpful relations established with the Esquimo, and in the relics found of previous Arctic expeditions. The large collection of these relics now on view at the American Museum tells many a long past story of the triumph of discovery of new land, the drear lonesomeness and isolation of the work, and the failure of rescue when rescue was sorely needed.

It is a pleasure to extend greetings and congratulations to Mr. MacMillan and his companions and a cordial welcome home.

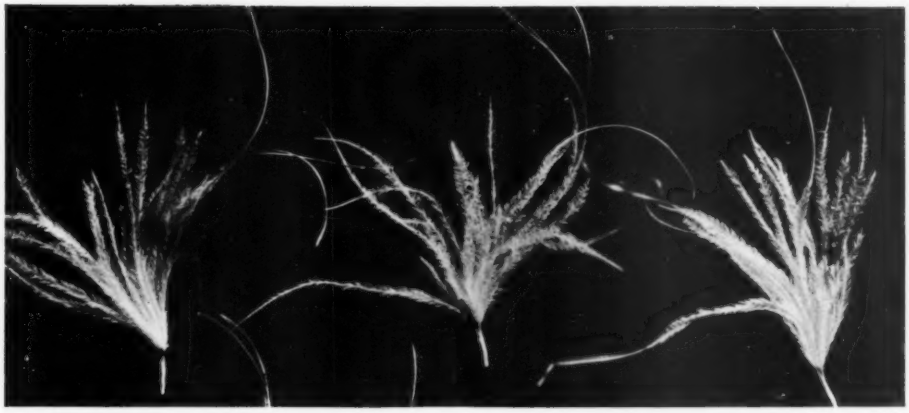
HENRY FAIRFIELD OSBORN.

[1] It will be the pleasure of the JOURNAL to publish in the next issue an illustrated article by Mr. MacMillan describing some of his experiences in the Arctic.—EDITOR

DOMESTICATED OSTRICHES OF SOUTH AFRICA

Note in this breeding cock ostrich (see hen in background) the black body feathers, the two-toed foot and naked tarsus with large scales along the front, the long neck covered with downlike feathers, and the small head. The head and tarsus of the breeding cock are bright scarlet. He is very vicious, many fatalities having occurred from his attacks. Breeding pairs have sold for as much as $5000

The cock bird may sit on the nest, and also take care of the young chicks when hatched. The eggs are turned over and rolled about with the beak before the bird crouches. As many eggs are placed in the nest as the bird can cover, usually from twelve to twenty. The hen sits by day and the cock takes duty by night



Some of the barbs of the natal down feathers are continued beyond the rest of the feather, and this gives the bristly appearance to the plumage of the young chick

Ostrich Farming in South Africa

SUCCESSFUL RESULTS SUGGESTING THE POSSIBILITY OF SAVING OTHER WILD BIRDS THROUGH DOMESTICATION

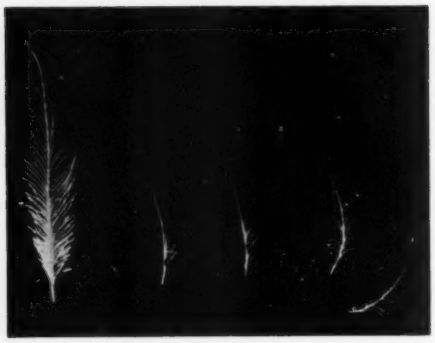
By J. E. DUERDEN

Professor of Zoölogy, Rhodes University College, Grahamstown, South Africa[1]

IN times past the two-toed ostrich (*Struthio*) ranged over all the habitable parts of the continent of Africa, and extended into Arabia, Palestine, Asia Minor, and probably as far as southern India. Any specific distinction within the genus is questionable. In recent times it has become practically restricted to Africa, a hardy "left over" from a more ancient fauna, in which brain power counted but little. Its graceful plumes have been employed for decorative purposes from time immemorial, and frequent references to the giant bird occur in Biblical and classical writings. The plumes were obtained from the hunting of the wild bird, and so valuable are they that the creature would have become extinct ere this had not its domestication been undertaken. As it is, ostriches in South Africa have rapidly increased under farming conditions, until in 1913 they were estimated at near 1,000,000, a noteworthy instance of an animal saved from extinction and increasing greatly in numbers through man's agency.

For generations the Arabs and natives of North Africa have kept the ostrich in captivity in small kraals, and ruthlessly plucked its feathers. These birds are captured as chicks from the nest of the wild bird, restraint and handling of the wild adult being impossible. Chicks are never bred in captivity, and the term "ostrich farming" can scarcely be applied to the crude conditions under which the bird there exists. Fifty years ago serious attention was first directed to the possibilities of ostrich farming in South Africa. Under suitable management the bird proved itself amenable to the restraints of farm life and bred freely, and in a

[1] Dr. Duerden holds also the position of Officer-in-Charge, Ostrich Investigations, Grootfontein School of Agriculture, Middelburg, South Africa.



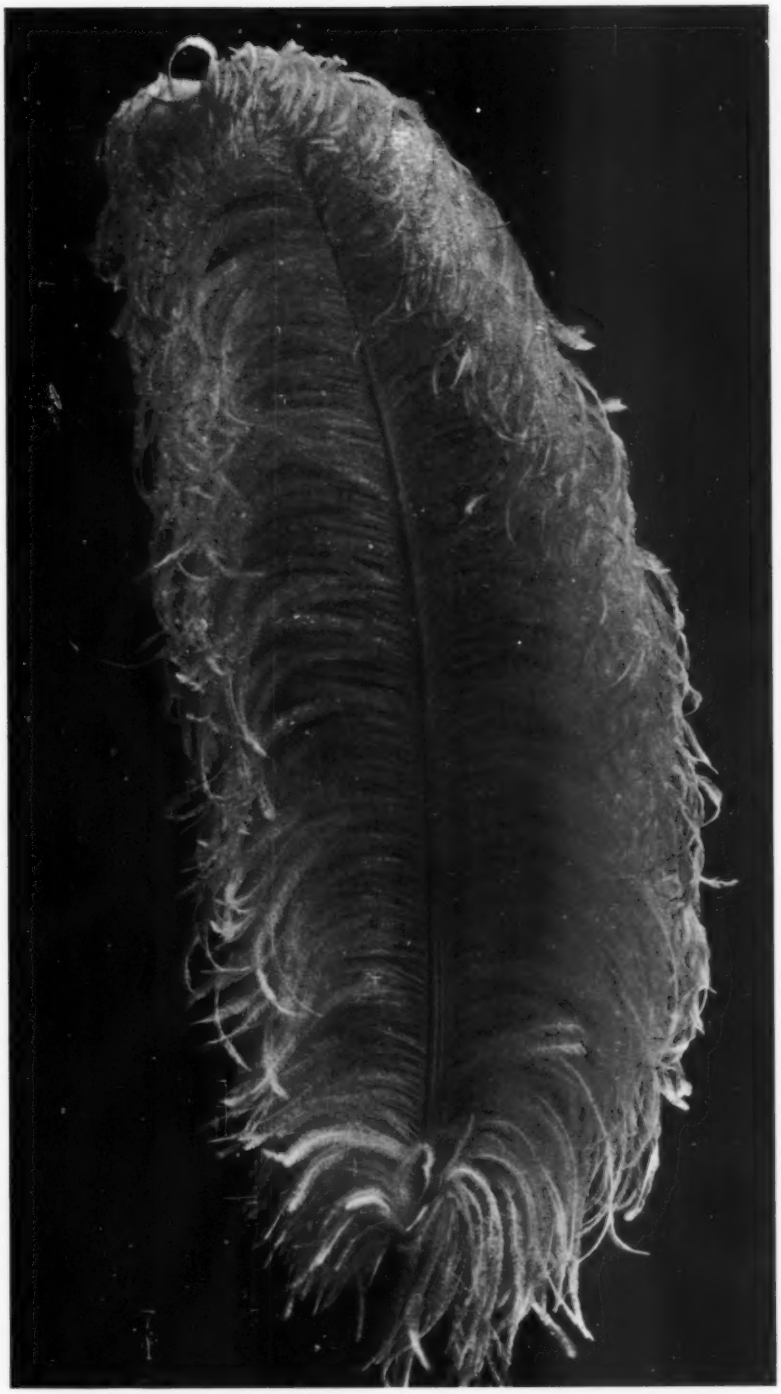
The "hair" in the feathers on the neck and head of an ostrich is the greatly elongated barbless shaft of the feather

The growing plume is highly sensitive to any changes in the nutritive condition of the bird. In this plume the tip or crown is well-grown, but, because the bird became reduced in condition, the rest of the feather is deeply "barred," tapers strongly toward the butt, and is otherwise defective. Defective growth renders the plume almost valueless commercially

short time ostrich farming became one of the leading pursuits of parts of Cape Colony. In 1913, the year before the beginning of the World War, the industry reached its zenith, when feathers to the value of $15,000,000 were exported overseas, mostly to Europe and the United States. An article of luxury, ostrich plumes have naturally suffered with the advent and continuation of the war.

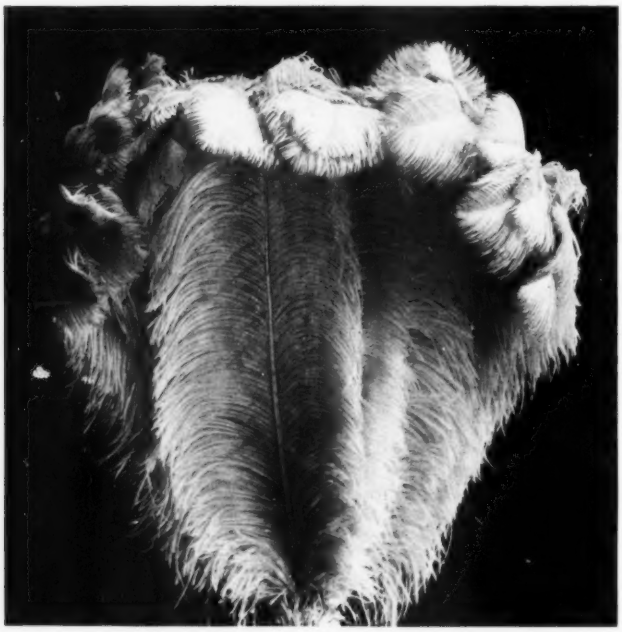
Although the ostrich is indigenous to Africa, it has been established that the domesticated bird will thrive and reproduce under varied conditions, and the remunerative nature of ostrich farming has led to its introduction into other parts of the world, particularly Arizona and California in the United States, and also Australia and New Zealand. The plumes produced in these parts are, however, by no means the equal of those grown in South Africa; and, as the bird is farmed only for the feathers it provides, it seems doubtful whether the industry can be made a success beyond the confines of Africa, especially since the exportation of birds is now prohibited by the Union Government. As in so many other highly specialized animal and vegetable products, peculiarities of soil, climate, and the general environment have much influence upon ultimate success; and even in ostrich areas in South Africa great differences obtain in the degree of plumage perfection attained.

It is no small achievement for the South African farmer to have reduced within fifty years a wild, highly nervous bird to a thorough state of domestication, to have worked out the details of management required for the production of successive plumage crops of the highest perfection, to have combated the many parasitic diseases to which the bird is subject, to have elaborated methods of chick rearing, and, by selective breeding, to have improved the plume to the high state of excellence it has now reached.



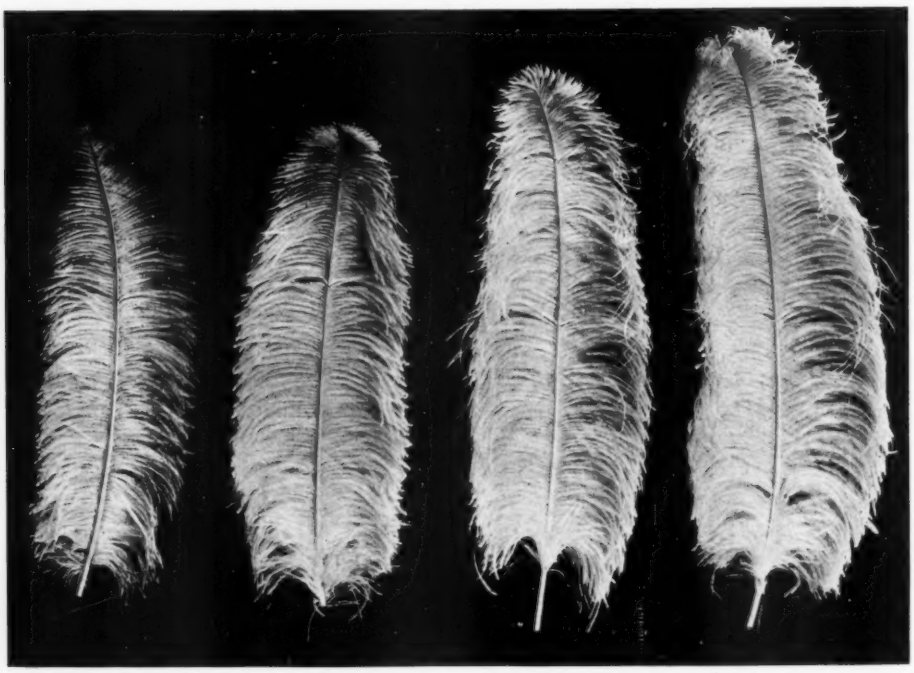
CLASSIFIED COMMERCIALLY AS A "HIGH GRADE NATURAL PRIME"

Plumes are graded and valued according to the possession of a large number of "points," among which are included size, shapeliness, density, and luster. The best plumes have usually a natural curliness at the crown and sides and are highly lustrous. A single plume like the above would be worth from five to ten dollars to the farmer. For millinery purposes two or three such feathers are laid together to give sufficient fullness



A full clipping of the prime feathers from an ostrich cock may weigh from ten to fourteen ounces, and be worth from fifty to one hundred dollars

A fact which is most impressive to the physiologist is the extraordinarily sensitive nature of the feather growth. Unless the bird is maintained in the highest nutritive condition throughout the six months required for a feather crop to grow and mature, the character and quality of the plumage suffer. Any imperfection of growth greatly depreciates the plume in value, often to the extent of one half or three quarters. The feather is an epidermal product, nourished from a long



These are wing plumes from the first, second, third, and fourth clippings. The plumes of the first clipping, termed "spadonas," are not of much value. Plumes usually continue to improve to the third or fourth clipping, and with proper management the bird will yield the same quality of plumage for many years

dermal medulla, and like all epidermal structures—hairs, nails, hoofs, and horns—is delicately responsive to nutritive variations and changes in external conditions. Even the normal variations in blood pressure between the night and day periods often leave their mark upon the growing plume in the form of night and day rings. These represent alternating differences in density in the new feather growth, and are the foundation of the prevalent defects technically known as bars, the nature of which has been investigated for several years by the writer. The longest plumes have a growth at the rate of a quarter of an inch a day, and all the feathers are so many projecting cylinders full of blood capillaries, closed at the outer end and open below to the blood supply. To maintain the uniform blood pressure necessary for the growing feather to attain its highest perfection demands a constant supply of highly nourishing food, such as alfalfa, rape, mangel, and all kinds of grain. It can safely be said that no animal is so highly cared for, and leads such a pampered existence, as the high-grade domesticated ostrich. The farmer, however, has no option in the matter. The difference in returns from a perfectly grown, high quality feather crop and one defective in growth is often the difference between prosperity and failure.

The method of securing a full, complete, and even feather crop is a matter of some interest to the zoölogist. In North Africa the entire plumage is usually plucked from the body, wings, and tail, which leads to rapid deterioration in the successive crops; but in methodical ostrich farming, only the three main rows of wing feathers are taken, along with the tail. With care the normal character of the plumage may be preserved year after year, maybe for fifty or more years. In farming, the object is to maintain all the commercial feathers at the same stage of growth at the same time, in other words, to keep the crop even. The natural method does not suffice, for the moulting of the various plumes is irregular; some are only partly grown while others are ripe or overripe. Further, to allow the plumes to remain on the bird until natural moulting takes place would result in a serious deterioration and depreciation in value, as a result of the wear and tear during the two or more months after the plume is ripe. Hence all feathers are clipped as soon as the plume part is fully developed, and then the quill is allowed to remain in the socket until it ripens also, the process requiring at least two months after clipping has taken place.

The first clipping occurs when the chicks are six months old, and all the commercial feathers, technically called spadonas, are removed. The quills remaining are then fully ripe in about two months' time, that is, all the medulla, with its blood and nerves, is withdrawn, and the tip of the quill rounded off. Left to natural moulting, these fully grown quills would be pushed out at different times, and the second crop of feathers would begin to grow in an irregular manner. To prevent this all the quills are drawn by hand when ripe, the chicks being then about eight months old; and invariably the withdrawal of a quill acts as a stimulus to the germ of the new feather at the bottom of the socket or follicle. All the old quills being drawn simultaneously, the new feathers begin their growth together, and a second full and even crop is secured. This also requires six months to ripen from the time of drawing the quills, so that the second feather crop is ready for clipping by the time the bird is fourteen months old. Two months later the second crop of quills can be drawn, and the third feather crop starts its growth, to be completed by the time the bird is two years old. The third clipping usually represents plumage maturity, that

is, it is the best crop the bird will produce. With care and good management, however, little depreciation follows for a number of years.

The ostrich plume owes its success as an article of adornment throughout the ages to its intrinsic grace and beauty and, in these later times, when humane principles are in the ascendency, to the fact that no cruelty or destruction whatever is involved in its production. The clipping of the ripe plumes involves no more to the bird than cutting the hair or trimming the nails does to man, or shearing the wool does to sheep. Feathers, hairs, nails, and wool are all epidermal structures, devoid of nerves and blood vessels, and no pain is connected with their removal once growth is complete. The drawing of the ripened quills is only performing for the bird in advance and simultaneously what would take place more slowly and irregularly in the natural process of moulting. It is this knowledge which in all recent legislative enactments devoted to the prohibition of trade in plumage has led to the exemption of ostrich plumage from any repressive regulations.

The wild ostrich breeds when four or five years old, but the domesticated bird from two to three years of age, or even before two years, a remarkable instance of the influence of high feeding in hastening the physiological processes of reproduction—combined with a certain amount of unconscious selection on the part of the farmer. The six-week period of incubation is undertaken in the nest by the cock at night and the hen by day, or is carried out artificially in the incubator. There is no support for the myth that the eggs are left to be hatched by the sun.

In a dry climate and free from parasitic attacks the chicks are hardy, and their rearing presents no difficulty. But with each succeeding generation the primitive wild nature of the bird tends to assert itself and needs to be overcome, the tameness attained by the parents being in no measure transmitted to the offspring. Left for a few weeks to themselves, or even with the parents, the natural wildness would become established, and during their subsequent career it would become practically impossible to handle them. To overcome this instinctive tendency to wildness, chicks for their first year or so have to be reared in close and constant association with people on the farm, when their nervous fear at the presence and approach of human beings remains in abeyance. Familiarity breeding contempt, the natural fear of man in the ostrich turns to aggression at the breeding season; and many a prancing cock in the full glory of its sexual vigor has stricken terror into the heart of the hapless person who has, unwittingly and unarmed, intruded on its territory, whether veld or camp; and many a violent kick has been received from its flattened foot, or a cut from its sharp powerful claw, resulting in serious injury or even fatality.

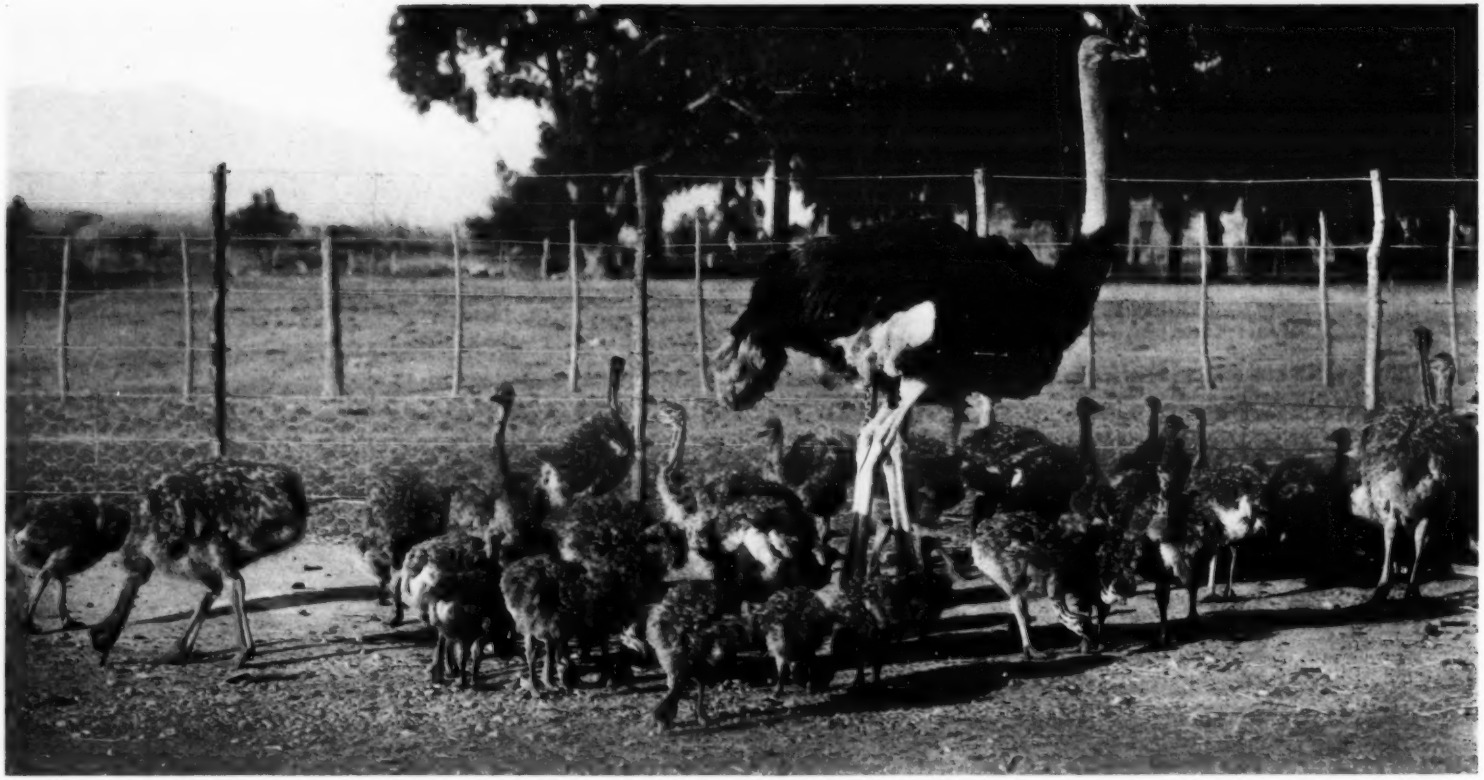
The domesticated ostrich also affords much that is attractive to the student of animal behavior. Along with other old-time African animals, such as the giraffe, rhinoceros, and hippopotamus, it combines a maximum of bulk with a minimum of brain. Like these and the big Mesozoic saurians and early Tertiary mammals, its nervous activities are mainly reflex in character, not mental. If intelligence be defined as the ability to profit by experience, then the ostrich is deplorably lacking in this desirable quality. Even in such remote times as those of the patriarch Job, aspersions were cast at the mentality of the bird. For do we not read: "God hath deprived her of wisdom, neither hath he imparted to her understanding."

Its oft-quoted proverbial stupidity in burying its head in the sand when pursued, believing itself thereby hidden from view, has however no foundation in fact, unless the instinct of death-

Group of chicks about five months old showing the mottled juvenal plumage, practically alike in both sexes. The chick in the foreground is half crouching on its ankles and toes

During their first year the chicks require constant handling and continual association with the people on the farm to prevent the development of their instinctive wild nature. It is impossible to handle an ostrich when it becomes adult, if it has not been thus tamed

In this group of plucking birds in an alfalfa camp, the black body plumage of the adult cock birds and the gray plumage of hen birds can be distinguished. The wing plumes are pure white in the cock, but usually have a small amount of gray pigment in the hen



BREEDING COCK OSTRICH WITH FAMILY

When the adult birds have hatched their chicks, they will take charge of any number of others in addition to their own, so long as those added are younger. In the plumage of the chicks note the bristly mottled feathers, and the bars and patches of dark color along the neck

feigning in the chick, when on sudden alarm it flops down with its long neck and head prone on the ground, can be regarded as the origin of the opprobrium. In handling the bird, as during the operations of clipping and quilling, the eyes are hooded and its nervous restlessness is thereby overcome.

Personal attachments and responsiveness, such as are manifested by all domesticated animals toward those who care for them, are wholly lacking in the ostrich. A glimmering of distinction between the familiar and the unfamiliar person, and a feeble tendency to the formation of the simplest habits, such as coming at call to be fed or traveling more readily along frequented directions, represent practically all the education of which the bird is capable. Attachment between mates, even after being camped together season after season, seems nonexistent; and the regard and care of offspring have manifestations of only the simplest character.

The success which has attended the domestication of the ostrich as a means of plumage supply has stimulated thought in South Africa in the direction of the domestication of other plumage birds. It is held that just as one bird has been rendered amenable to farming practice, and done much to adorn the world, so others may be adapted according to their own particular instincts and needs. His own industry conducted on the highest humane principles, the South African farmer has no sympathy with the ruthless destruction of wild bird life for millinery purposes. Rather, however, than follow a wholly repressive or prohibitive policy, he would inquire if birds suitable for the purpose could not, as in the case of the ostrich, be brought to render legitimate service to the decorative needs of mankind. No personal adornment is so attractive as that of plumage; peoples of all lands and in all times have been held in sway by it—the ostrich plume has been transported from the native kraal even to the thrones of kings and queens; and, if secured under circumstances in harmony with the highest humane considerations, a high service is rendered the æsthetic nature of man.

SKULLS OF HUMAN INFANT (ABOVE) AND YOUNG CHIMPANZEE (BELOW)

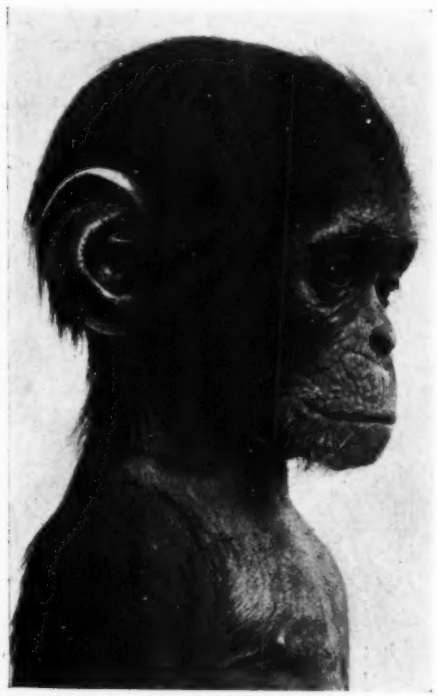
The elements of the human skull are homologous with those of the ape, the differences between the two arising from the great expansion of the brain and the deepening and shortening of the face in man

Evolution of the Human Face

CHIEF STAGES IN ITS DEVELOPMENT FROM THE LOWEST FORMS OF LIFE TO MAN[1]

By WILLIAM K. GREGORY

I SUPPOSE if you have talked to people about evolution they have said: "Well, if monkey-like animals evolved into men at one time, why did not all monkeys evolve into men, and why are there any monkeys alive at the present time?" They ask me to explain it, and they regard it as an insurmountable objection to the theory that man has evolved from lower mammals. Now I do not know why all the monkey-like animals did not evolve into men instead of changing only a little and remaining monkeys, but I do know that evolution, besides proceeding in different directions, also proceeds at different rates at different times. I know that just as there are many very advanced and progressive races, such as the horse and the humming bird and the whale, which have undergone a very great modification during the vast period known as the Age of Mammals, so there are also many conservative and backward races, such as the tapir and the opossum and the tuatara, which have undergone very little modification during the same period. These backward and primitive races are of the greatest use to us in deciphering the evolutionary history of past ages. They are living relics, or living fossils. A great many such relics are living today. That is what furnishes the material for comparative anatomy. It is by the dissection and study of these extant fossils and by comparing them one with the other, that we can trace out the stages by which structures have changed slowly, one into the other, and by which types have changed, one into the other. Now the monkeys and apes are relics of the middle periods of the Age of Mammals, and we know from the fossil remains that they have changed but little during that period. A possible reason is that most of them have continued to live in the forests and have therefore kept their primitive tree-living habits unchanged, while only a few, such as



Young chimpanzee which has a short face and an exceedingly large forehead much like that of a young child (see page 376). Photographed by Herbert Lang on the American Museum Expedition to the Belgian Congo

[1] Lecture delivered before the Linnæan Society of New York, February 27, 1917.

the baboons and the early predecessors of man, have left the forests and taken up wholly new habits on the plains, so that under the pressure of new conditions of life they have changed profoundly. But although other factors may be involved in the final answer to the question why have all the monkeys not evolved into men, it is true that by saving these relics of long past ages Nature has provided us with materials for elucidating the evolutionary history of human structures.

In considering the evolution of the human face, we gain a better perspective by beginning with the lowest animals and working upward. It seems that in the course of evolution the oldest part of the face is the mouth. The primary business of the face, in fact, is to direct the mouth toward the food. Some of the lowest, one-celled animals show this first essential of a face, which leads into a cavity that serves as a stomach, and among the anemones and corals and their relatives we find a well developed mouth, surrounded by sensory organs (tentacles).

The flatworms show the presence of eyes in a very primitive condition, another structure which goes to make up the face of higher types; that is, there is a concentration of nervous tissue sensitive to light at one end of the animal, which is shaped so as to progress in a forward direction, with the beginnings of a head and of a tail. In *Peripatus,* a wormlike animal, there are little tubercles on the skin equipped with hooks which help to pull the food into the mouth, and a number of paired limblike appendages on either side behind the mouth. These appendages become of importance in insects and crustaceans, those at the front end of the series becoming modified into sensory structures and also in many cases serving to get food and convey it to the mouth.

In some insects the tough skin which covers these appendages has been modified into a sawlike edge, and here we have a suggestion of jaws, which are the next great element to be added to the face.

Finally we see in many ordinary insects, such as a grasshopper, a rather high type of face for this grade of animal. It is completely armored on the surface with a tough skin. In many lower types of vertebrates also the head is armor-plated like the rest of the body so that the head is protected by a helmet and the body by a cuirass. Insects naturally evolved a kind of face with a number of the characteristics of the face of higher animals, because some sort of face involving a mouth and jaws and paired sense organs is necessary at the front end of any animal that goes after its food in a fore-and-aft direction.

The very ancient fishlike vertebrates of the Silurian and Devonian ages also had a head covered with a bony skin which formed a cuirass and a helmet, and in some (*Bothriolepis,* etc.) the eyes were on top of this helmet much as they are in the grasshopper. The jaw parts of this vertebrate are likewise made up of bony plates on the surface, and no doubt the muscles pulled these jawlike plates back and forth much as they do in the insects. I do not mean that this fishlike animal with its grasshopper-like face has been evolved from the insect plan of organization; I am merely suggesting that general resemblances of this sort are frequently evolved in widely different groups in response to similar functional needs.

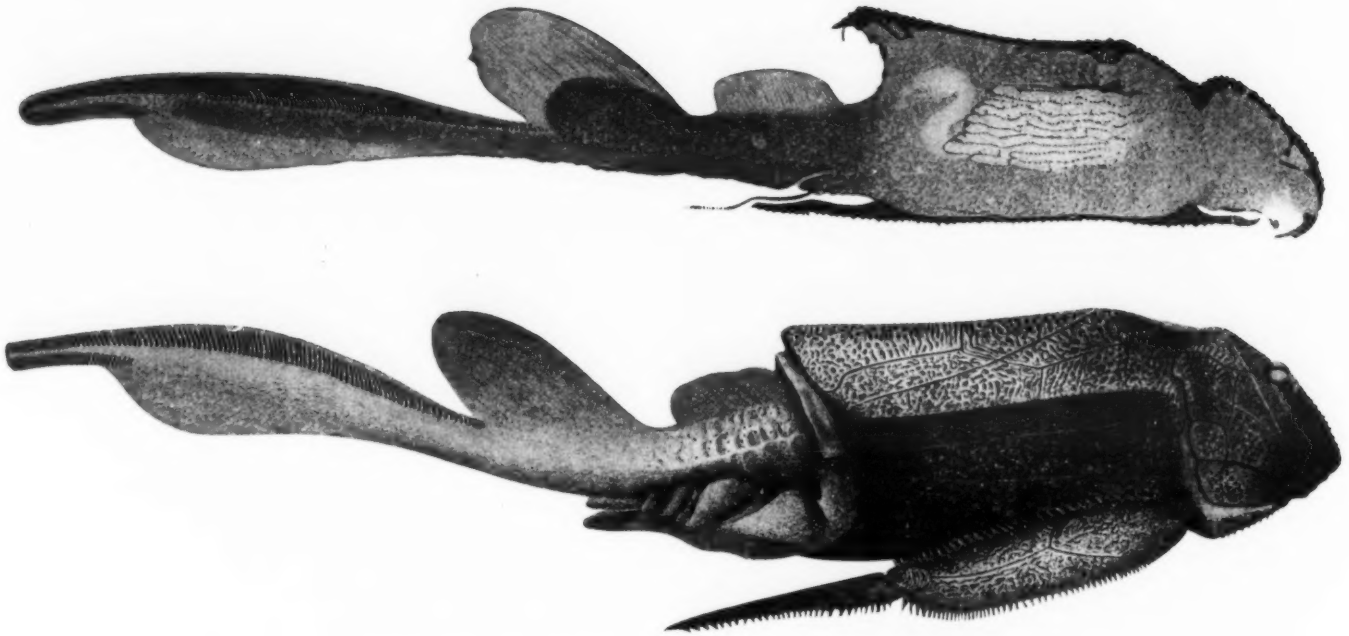
It is not until we reach the sharks, which are the most normal and typical

of the fishlike vertebrates, that we see the vertebrate face in its typical form and that we see all the elements which are characteristic of the face of mammals. Even the familiar landmarks of the human face are all present. We have the nostrils, which are only indefinitely foreshadowed in earlier types; we have the eyes, the mouth, the tongue, and the lips. But in the shark the whole face is covered with a tough skin.

In sharks we see for the first time the vertebrate face in typical form, with all the elements of the face of man—mouth, tongue, and lips to be brought into contact with the food by the locomotive organs, and nostrils and eyes to direct the locomotive organs. In the frilled shark (*Chlamydoselachus*) figured we see a suggestion of how teeth were formed in the higher vertebrates. The teeth within the shark's mouth are enlarged shagreen denticles such as grow on the skin outside the mouth. *After Garman*

In certain sharks (*Chlamydoselachus*) we see a suggestion as to how the teeth were formed in higher vertebrates. The tough skin, covering the head and body, is everywhere thickly studded with minute teeth, or denticles, the whole forming the "shagreen" of commerce. Now the teeth in the shark's mouth are nothing but enlarged shagreen denticles. At the sides of the mouth the denticles gradually become larger and the skin that bears them becomes drawn over the margins and on to the inner side of the jaws. I need hardly say that the evolution of the teeth of vertebrates has had a great influence upon the evolution of the face.

In the shark the face is very distinctly the directing part of the animal, at the front end of the backbone. We may say that all the elaborate locomotive organs (the backbone, the fins, and the muscles which move them) exist chiefly for the purpose of bringing the mouth into contact with the food, and that the higher elements of the face, namely the eyes and the nose, exist for the purpose of directing the locomotive apparatus toward the prey. In order to consume the food and transform its potential energy into action, the shark must of course have oxygen, which among fishes is extracted by the blood from the water surrounding the gills. These gills are supported by cartilaginous arches which are of the greatest importance in the later evolution of the face, since there is good evidence tending to show that the upper and lower halves of one of these gill arches actually gave rise to the upper and lower



ANCIENT FISHLIKE VERTEBRATE WITH HELMET AND CUIRASS

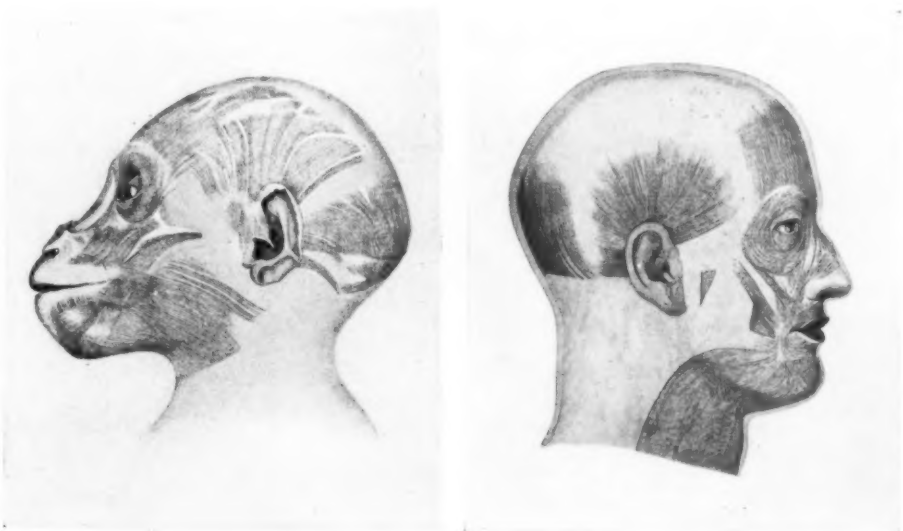
Just as many highly developed types of invertebrates, such as the grasshopper, have the head completely armored with a tough skin, so in many low types of vertebrates the head as well as the body is armor-plated. Such was true of *Bothriolepis*, an extinct "fish" from the Devonian of Canada. The bony shell covering the head and thorax served the same purpose as the chitinous armor of insects. The internal skeleton, if developed at all, must have consisted chiefly of connective tissue. General resemblances of this sort are frequently evolved in widely different groups in response to similar needs. *Restoration and longitudinal section after Patten*

jaws of the sharks, which are equivalent to the cartilaginous core of the upper and lower jaws of all the vertebrates above the sharks.

The fishes called "ganoids," of many different varieties, show a shiny surface armature covering the face, as also the body, recalling the insects with their hard outer shell. But the noteworthy thing about this ganoid sort of face is that the hard covering of the face and jaws has a bony substratum which completely invests the primary, underlying brain case and the primary or gill-arch jaws. This bony skin even extends inward along the roof of the mouth, forming the primitive hard palate, and along the inner as well as the outer side of the primary lower jaw, forming the sheathing bones of the jaw, which are typical of fishes and higher vertebrates. In this early stage of vertebrate evolution this bony mask lies fully on the inner and outer surfaces, but in the later evolutionary stages of all classes of vertebrates, these sheathing bones gradually sink below the surface, in proportion as a new layer of skin is generated on *their* surfaces, and as this new surface layer becomes thicker the original sheathing bones finally come to be buried deeply under the skin and often tightly appressed to the still deeper primary brain case and primary jaws.

There have come down to us from the Age of Reptiles a great many fossil reptiles and amphibians which show this shell of bone still on the surface, or very near the surface. Even in the modern alligators and crocodiles and turtles the bony mask lies immediately below the tough skin.

An aggressive looking amphibian (*Cacops*) from the Permian of Texas has the general type of face which was destined to give rise by diverse modifications to the characteristic faces of reptiles, and indirectly to those of the higher types. It still has the mask of



All mammals have facial muscles, producing a more or less mobile face. These muscles are very highly developed in man. In a comparison of gorilla (young) and white man (adult), homologous groups are seen, such as the muscles surrounding the eyes, the nasal muscles, and the muscles that lift the lip. One of the greatest gaps in the evidence of the evolution of the face is that there has been found no intermediate type between the immobile nonmuscular face of reptiles and the mobile muscular face of mammals. Comparative anatomy, however, shows how one may have evolved into the other. ***Figure after Ruge***

bone. It has a special interest, besides, since it possessed another very important structure in higher vertebrates—namely, an eardrum, which was doubtless stretched upon the bony rim behind the eye-sockets.

The Teju lizard represents a still higher grade of organization, the next step toward the mammals in one direction and toward the birds in another. It is an active, carnivorous animal, and its face is well protected by a mask of scaly skin. The bony mask is also still there, under the skin; but here is a point most important to remember, that if you took off the scaly skin of the face in this reptile, you would not find any facial muscles beneath the skin, such as are present in our own face. It is only on the under side of the jaws and throat that you would find a layer of muscles beneath the skin. In the absence of true facial muscles all reptiles are inferior in rank to the mammals, where facial muscles first appear. Birds have the immobile nonmuscular face of reptiles, further masked by a horny beak or bill; but the mammals have soft muscular lips and a muscular layer about the nose, eyes, forehead, and ears.

The facial muscles are supplied by branches of the seventh or facial nerve, which issues from the skull behind and below the ear. It is believed that the throat muscle in remote ancestors of mammals spreads upward between the bone and the skin, carrying the seventh nerve with it, and that as the muscle branched, the nerve also branched again and again, producing the highly mobile sensitive face of man. From Cunningham's *Anatomy*

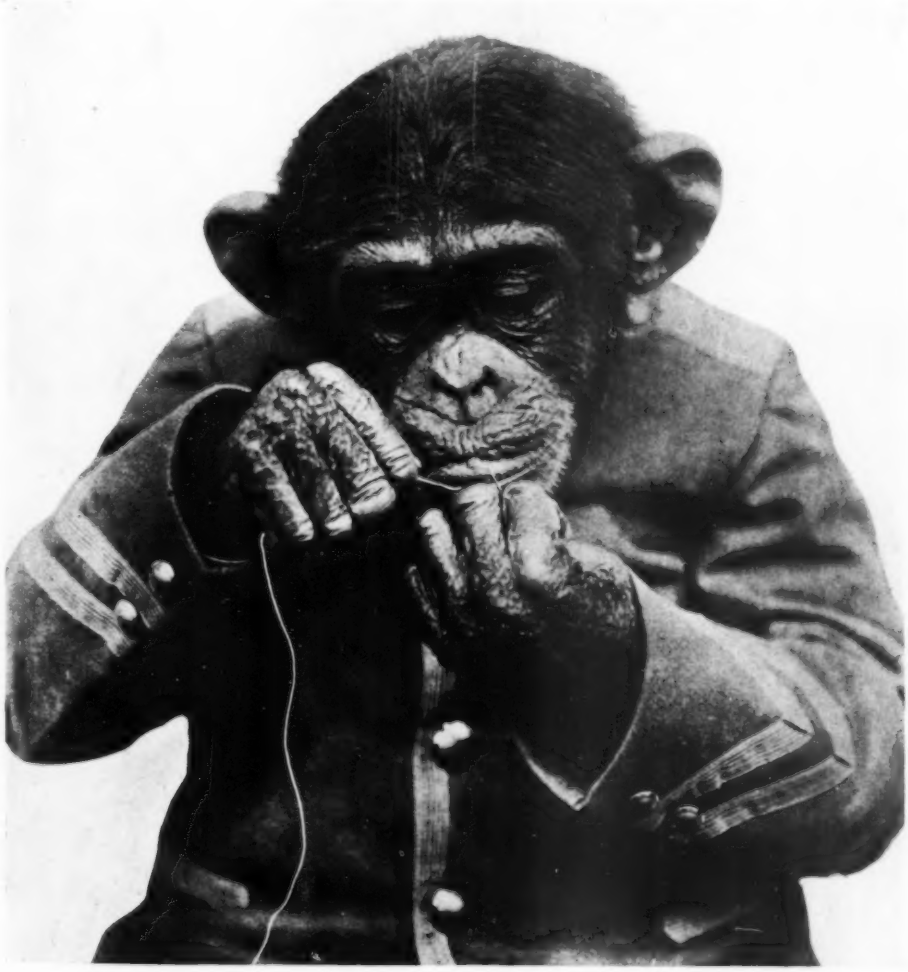
One of the greatest gaps in the whole record of the evolution of the face consists in this, that in spite of the relative abundance of living relics that preserve successive stages in the evolution of the skull itself, there is no animal known which has an intermediate type of face between the immobile nonmuscular face of reptiles and the mobile muscular face of mammals. In spite of this, comparative anatomy furnishes fairly clear evidence as to the exact process by which the one did evolve into the other.

The facial muscles of a typical mammal, a lemur (*Propithecus*), for instance, correspond with the facial muscles of man. They include the platysma covering the throat, the orbicular muscle around the eye, the muscles of the nose, the muscles that lift the lip, the muscles that draw back the corners of the mouth, and the buccinator, which is of great use not only in blowing a trumpet, as its name suggests, but also in protruding the lips and in pushing the food about inside the mouth.

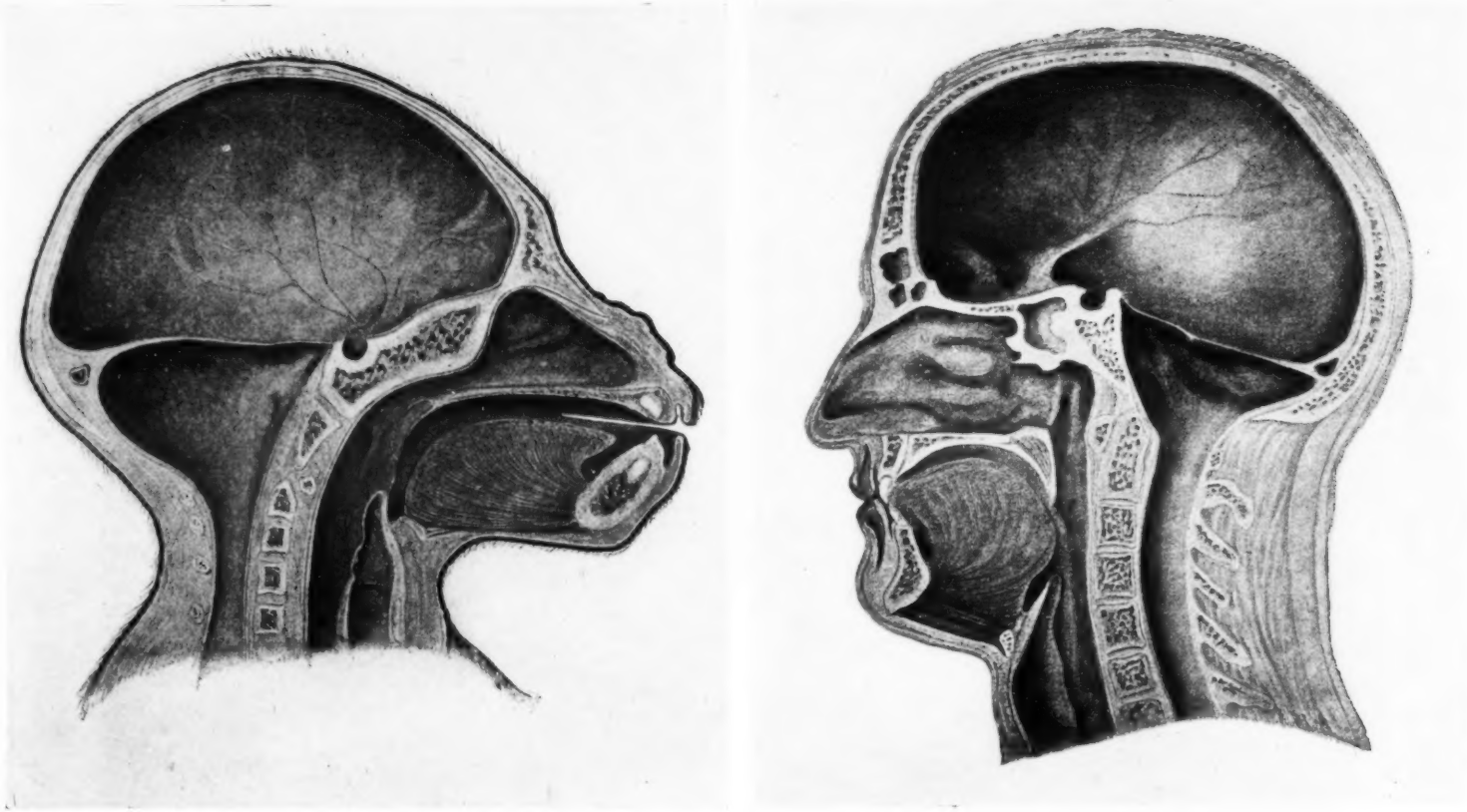
All these various muscles of the face in man are innervated by branches of the seventh or facial nerve. The facial nerve comes out from behind the ear, and turns forward, one branch going to the platysma muscle on the surface of the throat and the other in numerous branches and sub-branches, like a vine and its divisions, passing forward to supply the muscles of the face. This

fact gives the clue[1] to the origin of the facial muscles. In the remote ancestors of the mammals only the platysma and the immediately underlying sphincter colli muscles were present; it is highly probable that this sheet of nerve tissue gradually spread from the under side of the throat upward and forward along the sides of the face, by degrees creeping over the old bony mask and beneath the skin, carrying with it the seventh nerve, and dividing and subdividing into numerous branches and layers; at the same time the nerve branched and branched again, as nerves have frequently been known to do when muscles became subdivided. Several analogous cases of the spread of a muscle layer into a new region are known

[1] Theory put forth by Ruge. This is generally accepted by anatomists as the true explanation of the origin of the facial muscles of mammals.



The photograph shows the tense lips of a trained chimpanzee who is in the act of threading a needle. The action of the muscles of the human face is coördinated (especially in the child) with that of various other muscles of the body, and the same is noticeable in apes, which use the facial muscles much as we do but often with rather more emphasis than is usual in polite society. Courtesy of Professor W. T. Shepherd, of Washington, D. C.



BRAIN CASE AND FACE IN APE AND MAN

In the ape (young gorilla, at the left) the brain case is comparatively low, and the face is shallow; in man (adult white man, at the right) the brain case and the face are both very deep; the face has been retracted beneath the brain case. *Figure after Ruge*

or suspected, as in the case of the mammalian diaphragm which is believed to have arisen in the neck region and to have migrated backward, dragging its nerves with it.

The facial muscles in man not only correspond with those in other mammals, but they also show special detailed resemblances when compared with the facial muscles of apes. Darwin and other investigators found that apes use these muscles much as we do, but with rather more emphasis than is usual in polite society. When a child first takes lessons on the piano, the teacher sometimes has to remind him or her that the piano should be played with the hands and not with the face—and sometimes it takes considerable repression on the part of the beginner to keep the facial muscles still, while striving to do anything with the hands that requires intense concentration and effort. A trained chimpanzee, trying very hard to thread a needle, has an intent expression and very tense lips, reminding us of the familiar human trait.

A gorilla in anger lifts the lips so as to expose the canine teeth and swells the muscles that run to the corners of the mouth so that they can be seen standing out on the side of the face. The arrangement of the wrinkles on the face in apes as well as in man, seems to have a definite relation to the facial muscles, often forming across the pull of the underlying muscles. Perhaps the principal difference between the facial muscles of man and those of apes, apart from differences in relative size, is that in man the upper lip is full and protruded while in the apes it is a thin "hard" lip, very muscular, but tightly drawn.

The human nose is hardly an inspiring subject from an anatomical point of view: internally it is decidedly degenerate, as compared with that of other mammals, and externally it has nothing very wonderful about it, like the nose of the elephant or those of various bats. The adult human nose, at least in the higher races, differs from that of apes chiefly in the following characters: the bridge of the nose is higher; the whole nasal cartilage is produced forward and downward, often ending below in a well-shaped tip; the nose is narrower at the base in proportion to its height, and the nostrils face downward rather than forward. Now, however important these differences may be from an æsthetic point of view, they are rather small from the standpoint of evolution, the more so since the nose of the human fœtus in its earlier and less differentiated stages is decidedly more apelike than human. Even in babies the nose has by no means approached its adult human form. Among living apes the gorilla makes by far the nearest approach to the human condition in the shape of its nose, although the great width and the forward facing of the nostrils give it, according to human standards, a repulsive appearance.

In the face of the Australian black man we find some primitive gorilla-like characters along with others that are typically human. The nose is excessively wide at the base and the bridge between the eyes is very low, but the nostrils point downward and the tip of the nose is distinctly human.

A wonderfully well-studied restoration[1] of the extinct ape-man of Java (*Pithecanthropus*) shows a very wide nose, with the nostrils facing partly forward and partly downward, and with a deep depression above the nose,

[1] By Professor J. H. MacGregor, of Columbia University.

between the eyes; it also has a very thin upper lip and a partly everted lower lip; so that this mingling of human and apelike characters fully carries out the "missing link" idea which is so unmistakably indicated in the excessively low forehead and high brow ridges of this celebrated relic of a prehuman stage.

An interesting and grotesque caricature of certain human styles of nose is seen in two closely related genera of Asiatic monkeys, the "retroussé-nosed monkey" (*Rhinopithecus*) and the "proboscis monkey" (*Nasalis*). The former has the nose turned up at the tip and the nostrils facing forward, somewhat after the manner of a human fœtus, while the male proboscis monkey, as its name indicates, has its nose produced into a long downwardly directed tube with the nostrils facing downward. In the mandrill the inflated nose is made more striking to the eye by the addition of intensely blue and red pigments.

It has long been suspected that these variations of the nose in the higher Primates, including man, may have been brought about through sexual selection and that the form of nose has been determined by its decorative value, in accordance with the varied standards of beauty in the different races. Certain modern investigators, however, deny the potency of sexual selection to produce such results. Those who prefer to believe that differences in form are associated with differences in habit would perhaps favor the suggestion[1] that the downwardly pointing and hooded nostrils of man are primarily adapted to hunting habits and an upright gait, while the forwardly facing and open nostrils of the apes were adapted to frugivorous habits and a stooping gait. It may be also that the covered nostrils were better adapted for the rigorous, arid climate of the open plains, which according to my own view constituted the earliest habitat of men after they had abandoned their ancestral home in the forests.

Passing to a consideration of the origin of the human eyes, we find in the Primates many intergradations from the condition where the eyes are more lateral in position, to the anthropoid and human condition, in which the eyes are shifted together near the mid-line in front and can both be focused on an object near by in front of the face. This process of bringing the opposite eyes near each other has been carried even further in the orang-utan than in man, so that the bony partition between the eyes in the orang is excessively narrow.

The eyes of all the anthropoids are very human in character, but especially those of the young gorilla. The back of the eye of the chimpanzee as viewed through an ophthalmoscope,[2] is extremely human in appearance, much more than that of the orang, so that this human character of the chimpanzee eye extends even to the arrangement of the blood vessels and the appearance of the pigmented areas.

As every one knows, the forehead of adult male apes is very low as compared with that of normal men; but the young, both of men and apes, have a swelling forehead. The baby orang-utan shows the domelike forehead of the human infant, and the young chimpanzee[3] has an exceedingly large forehead much like that of a young child. The inference has accordingly been drawn by some authors that the common ancestor of apes and men did not

[1] Dr. George F. Stevens (*in litteris*).

[2] According to the beautiful colored plates of Dr. Lindsey Johnson. The gorilla is not figured among them.

[3] See illustration from photograph on p. 377.

have a sharply retreating forehead but a domelike one and a relatively very large brain case. Although space is lacking to discuss this question, I may be permitted to record my conviction that this inference is quite wrong and that the human race has been derived from large, powerful apelike forms with heavy jaws, massive jaw muscles and a sharply retreating forehead.

The evolution of the human forehead is well suggested if we examine a series of skulls. In an adult chimpanzee skull the forehead is very low and there are heavy ridges over the eyes. In the skull of an Australian black man also the forehead is low and there are well-defined brow ridges. In a modern European skull the forehead is high and the brow ridges are lacking. In the shape of the forehead the extinct ape-man of Java was almost exactly intermediate between the chimpanzee and the lowest known human forehead, that of the Neanderthal race of the Old Stone age. The brain case accordingly has progressively deepened in its vertical diameter, as we pass upward from an apelike stage.

These changes in the contour of the brain case merely reflect the more fundamental changes in the form of the brain which in the higher types becomes excessively voluminous and, as it were, presses out the forehead and skull top in all directions so that in short-headed races of men the head becomes almost spherical in form.

Every part of the bony face of Primates has no doubt been molded in the long run by the action of the facial muscles that press upon it. The partition of bone behind the eyes, for example, has grown downward and outward between the eye and its muscles which lie in front of it, and the powerful jaw muscle (temporal) lying behind it. The cheek bone has been deepened to give a strong support for the outer jaw muscle (masseter). The nasal bones have perhaps been molded to some extent by the muscles on either side of them.

In comparing men and apes one of the greatest differences is seen in the form of the front part of the upper jaw, which is associated with the marked differences in the form of the lips already alluded to, and with certain no less important differences in the character of the teeth and in the movement of the lower jaw. It seems very well established that as the primitive ape-men passed from the semi-erect to the fully erect posture, and as the rapidly expanding brain case became balanced at the top of the progressively up-tilted backbone, the whole front part of the jaws and lips was drawn backward beneath the overgrowing front part of the brain case; meanwhile the lower jaw and the whole head increased greatly in vertical height, but shortened equally in fore-and-aft length; the width across the brain case increased, the sockets of the lower jaws moved apart and the opposite halves of the jaws became sharply inclined toward each other, so that the front teeth were all drawn backward; the palate and the lower jaw were thus shortened, and the dental arches assumed an arch-like curve, the crowding of the front part of the jaw being partly associated with the marked reduction in size of the canine and premolar teeth.

A multitude of minor changes and readjustments took place at this critical time, but they were nearly all the direct result of the general tendency to shorten the face and draw it inward beneath the overgrowing, forward expansion of the brain case. Among other important consequences of this general retreat of

the face and its bony substructure, were the downward and outward growth of the nose and the forward growth of the chin.

The evolution of the chin has given rise to an extensive literature. Some writers ascribe its existence to the excessive development of the genioglossus muscle, which runs from the hinder surface of the chin into the lower part of the tongue and which throws the tongue into the rapidly shifting positions assumed in articulate speech. Other writers ascribe the outgrowth of the bony chin to the withdrawal backward of the dental arch, to the increased pressure in the chin region, and to the turning outward of the lower rim of the jaw. Others regard the chin, like the nose, as a direct outgrowth, of no great functional importance, but linked in some way with the progressive improvement, according to human standards, in the appearance of the whole face. The present writer has sought to connect all these changes, including the reduction in size of the canines and bicuspids, with a profound change of food habits from the omnivorous-frugivorous habits of forest-living apes to the predatory carnivorous habits of plains-living men.

The profound disturbances and readjustments in the brain, brain case, and face were accompanied by equally far-reaching changes in the backbone and in the pelvis and in the bones and muscles of the limbs. The forearms, no longer used in the stooping posture, shortened, while the legs rapidly lengthened, so that men very early became fast runners on the open plains.

In conclusion, if we compare the skull of a young anthropoid ape with that of a young human being we shall find that every bone in the ape skull may readily be identified in a slightly different form in the human skull; the number and kinds of teeth are the same, both in the milk and permanent dentitions, and even the crown-patterns of the molar and bicuspid teeth are fundamentally similar in primitive apes and men. In spite of all the readjustments following the assumption of the fully upright gait and the change in food habits, the differences between the primitive ape skull and the human skull are essentially differences of proportion and of degree rather than of kind.

From the palæontological viewpoint these numerous and fundamental resemblances can only mean that living apes and men have evolved from a remote and as yet undiscovered common ancestor that lived perhaps in the middle period of the Age of Mammals. I believe also that the living apes, because they have stayed in the ancestral habitat, have retained the greater part of the ancestral man-ape characters, and that the ancestral pattern of the human face may still be seen in a little changed state in the faces of young female gorillas and chimpanzees.

Photographs of American Sperm Whaling

TAKEN ON BOARD THE NEW BEDFORD BRIG "DAISY," IN 1912 AND 1913, DURING THE SOUTH GEORGIA EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY AND THE BROOKLYN MUSEUM

By ROBERT CUSHMAN MURPHY

THE WHALEBOAT

Constructed of flawless cedar, seaworthy and graceful, sharp at both stem and stern, the whaleboat when ready for service is a marvel of order and efficiency compacted within thirty feet of length. A whaleboat rows lightly and sails like a yacht; it spins smoothly on the sea following the terrific dodges of a harpooned whale; and it withstands the severe stress of being raised and lowered by its ends when laden with a crew of six men and sometimes half-filled with sea water

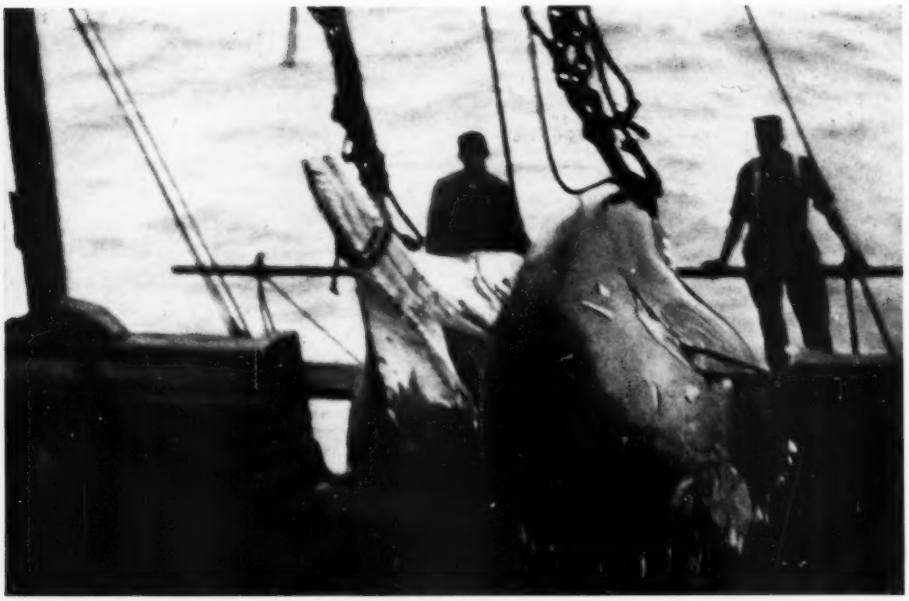
LOWERING AWAY

At the word of command the cranes swing back, the falls slacken away, and the second mate's boat drops to the water, the crew following by way of the slide-boards and tackles. Each man takes his place, with the harpooner at the bow oar and the boat header at the helm. Unless there be no breeze, or the whales lie to windward, the mast is soon stepped and the chase made under sail

A few strokes put the little craft safely away from the ship. This photograph shows the mast and sail, two of the keen toggle irons resting on the gunwale, and the manila whale line which passes out through a notch in the bow. The men follow directions signaled to them by the captain

From his lofty perch at the masthead, the captain can see movements of the whales quite invisible to the harpooners, and by a system of signals with waifs and the clews of the square sails, he directs the course of the boats

A chain passed through a starboard hawse pipe is fastened around the whale's "small," and when drawn in snugly, the victim lies with his flukes near the bow and his head stretching along past the waist. The operations of bringing a whale alongside and of making it fast are called sweeping and fluking. The boat hanging on the forward davits is the writer's dory, not part of the regular whaling equipment of the brig



Here the main parts of a small sperm whale's head—the "junk" and the jaw—are being hoisted aboard by the cutting tackle. An iron blubber hook is caught in the whale's single nostril, or blowhole, which is on the left side of the snout. The great block of head tissue includes the "case" containing the spermaceti, but none of the skull

Sperm Whale's Eye.—The camera was pointed directly downward from the quarter-deck. The huge carcass lies on its side—just awash—limberly yielding to every swell, with the great blunt head stretching to the quarter, the closed eye and the infinitesimal ear-opening breaking above the surface

CUTTING TACKLE AND BLANKET PIECE

A cluster of gigantic blocks, hung by hawsers as thick as a man's leg from the head of the main-mast—through these are rove the ropes which raise the tons of blubber from the water to the main hatch. The blanket piece now attached includes the whale's flipper

"Blow, Blow, Blow the Man Down!"—The double hawsers from the cutting tackle run to the windlass on the topgallant fo'c'sle, and here, under the eye of the "Old Man" himself, the greater part of the crew rock the windlass, and so haul in the strips of blubber as they are loosened from the whale. This is the cheery part of the business, which cannot be done without song

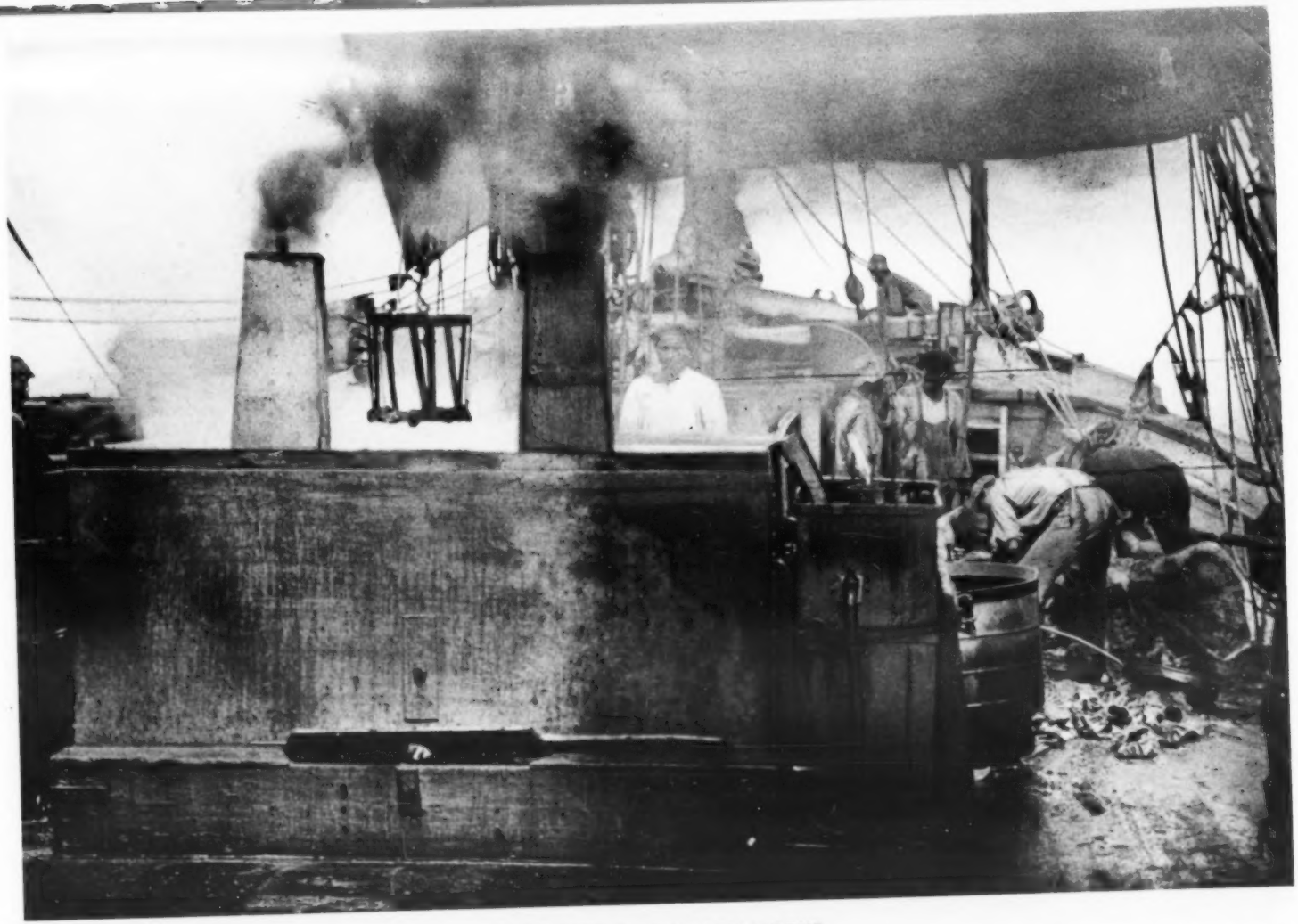
Peeling the Blackskin.—The fibrous, gristly blubber of the upper head is cut off in squarish blankets, an operation known as "peeling the blackskin." These chunks are as elastic and resistant as so much rubber, and they make excellent chopping blocks or mats on which the solid, oleaginous blubber of the "junk" may be cut up without danger of chipping the keen edges of the deck spades

BAILING THE CASE

A large sperm whale's head is too heavy to be hoisted on deck, and it is necessary to bail out the spermaceti while the "case" is partly buoyed up by the water. A long, narrow bucket, suspended on a pole, is lowered into the huge cistern of oil. The pole pushes the bucket down, and then the latter is hauled out, as from a well, filled to the brim and dripping with liquid spermaceti. The operation is repeated again and again, until the long pole pushes the bucket down fifteen or twenty feet, and drains the last few gallons

Filling the "Blubber Parlor."—The blanket pieces are reduced to small blocks by men with short-handled blubber spades, and these blocks are stored between decks during the cutting-in. Everyone is hustling, hauling, chopping, lashing, stowing, and sliding "galley-west" on the greasy planks. Night does not put an end to the work on board. At sea one can be sure only of the present, and it is to everybody's interest to complete the cutting-in, and the boiling of the blubber, before signs of a storm appear

The Try-pots.—A view from the rigging. Strips of blubber called "horse pieces" are minced so that the heat may penetrate every part. Each strip is cut transversely into thin slices, but these are not severed completely; enough of the tough outer layer is left so that the slices cling together, like bacon on the rind, and the whole "bible" can be manipulated on a blubber fork. Boiling goes on until the bibles, crisp, shriveled, and of a golden brown color, rise to the surface and float like clinkers. They then constitute the "scrap," which is the fuel of this self-supporting process



DECK VIEW OF THE TRY-WORKS

The try-works comprise two iron pots in a brick support, situated on the forward deck. Beside them stands the iron cooler, into which the boiled oil is ladled before passing to the tanks and casks below. Above is the smoke sail, intended to keep at least a part of the sooty smoke out of the cabin. Between the chimneys hangs an iron cresset, the "bug-light"; when filled with burning scrap it throws a weird glare over the deck during the night shift

Photograph by C. Hart Merriam

MANZANITA FOREST OF CLEAR LAKE, CALIFORNIA

The Clear Lake manzanita forests in a state of nature are almost impenetrable, but where thinned by man, they form open groves of surprising beauty. The ground is carpeted with the dry leaves and large dark red berries, while the smoothly polished trunks of deep red support an arbor-like canopy of light green foliage, through which a lattice of flickering shadows is projected to the path beneath. So great are the charm and the quiet restfulness of these Clear Lake forests that one is tempted to return to them again and again

The Giant Manzanitas of Clear Lake, California

By C. HART MERRIAM

IN the warmer parts of California hundreds of square miles of hill slopes are densely covered with a continuous mass of rigid bushes or brush of many species, usually wind-trimmed to a common height, and collectively known as "chaparral." The component shrubs vary locally, but as a rule consist mainly of species of wild lilac (*Ceanothus*), manzanita (*Arctostaphylos*), chemisal (*Adenostoma*), scrub oak (*Quercus*), buckthorn (*Rhamnus*), and toyon or Christmas berry (*Heteromeles*), with representatives of many other genera.[1]

Of these, the manzanitas, because of their smooth red branches and in some cases also because of the pale color of the foliage, stand out most conspicuously. In dense chaparral they conform in height to the associated species (say four to six feet), but in more open situations they grow in compact clumps ten to twelve or even fifteen feet in height. This is particularly true of the greenleaf species known as *Arctostaphylos manzanita*, which often becomes the dominant social type over areas of considerable extent.

In places along the west flank of the Sierra Nevada, on certain slopes of Mt. St. Helena and Mt. Konokti in Lake County, in the upper valley of Russian River, and in a few other localities, the manzanitas attain still larger size, while on flat ground on the west side of Clear Lake near its junction with Upper Lake,[2] they reach their highest development, forming a veritable forest about twenty-five feet in height, although many of the slanting limbs measure thirty feet, with hundreds of trunks whose diameters exceed a foot and some that attain the extraordinary thickness of upward of two feet.

Owing to the closeness of stand of the individual trees and the persistence and rigidity of the dead trunks and branches, this wonderful forest in a state of nature is almost impenetrable, but where thinned by man it is converted into an open grove of surprising beauty. The ground beneath is carpeted with the old dry leaves and large dark red berries, while the smoothly polished trunks of deep red, suggesting the madrones of the coast belt, support an arbor-like canopy of light yellow-green foliage which overarches the paths and roadways with a lattice of flickering shadows, affording welcome protection from the hot summer sun.

There are dwarf forests in other places—some on the coast, some in the interior, some on the bleak summits of lofty mountains, some on the warm bottoms of fertile valleys, but none like the manzanita forests of Clear Lake. The others attract the attention because of their stunted size; the Clear Lake manzanitas because of their large size—large in contrast with the usual bushy form characteristic of manzanitas elsewhere. But the effect is the same, both types resulting in dwarf forests whose branches and foliage form a canopy low down over our heads. In both cases there is a something about them—an intangible something—that makes them peculiarly attractive. Is it their rarity and unfamiliar aspect? Or is it the fact that they are nearer our own size, bringing us in closer touch with their

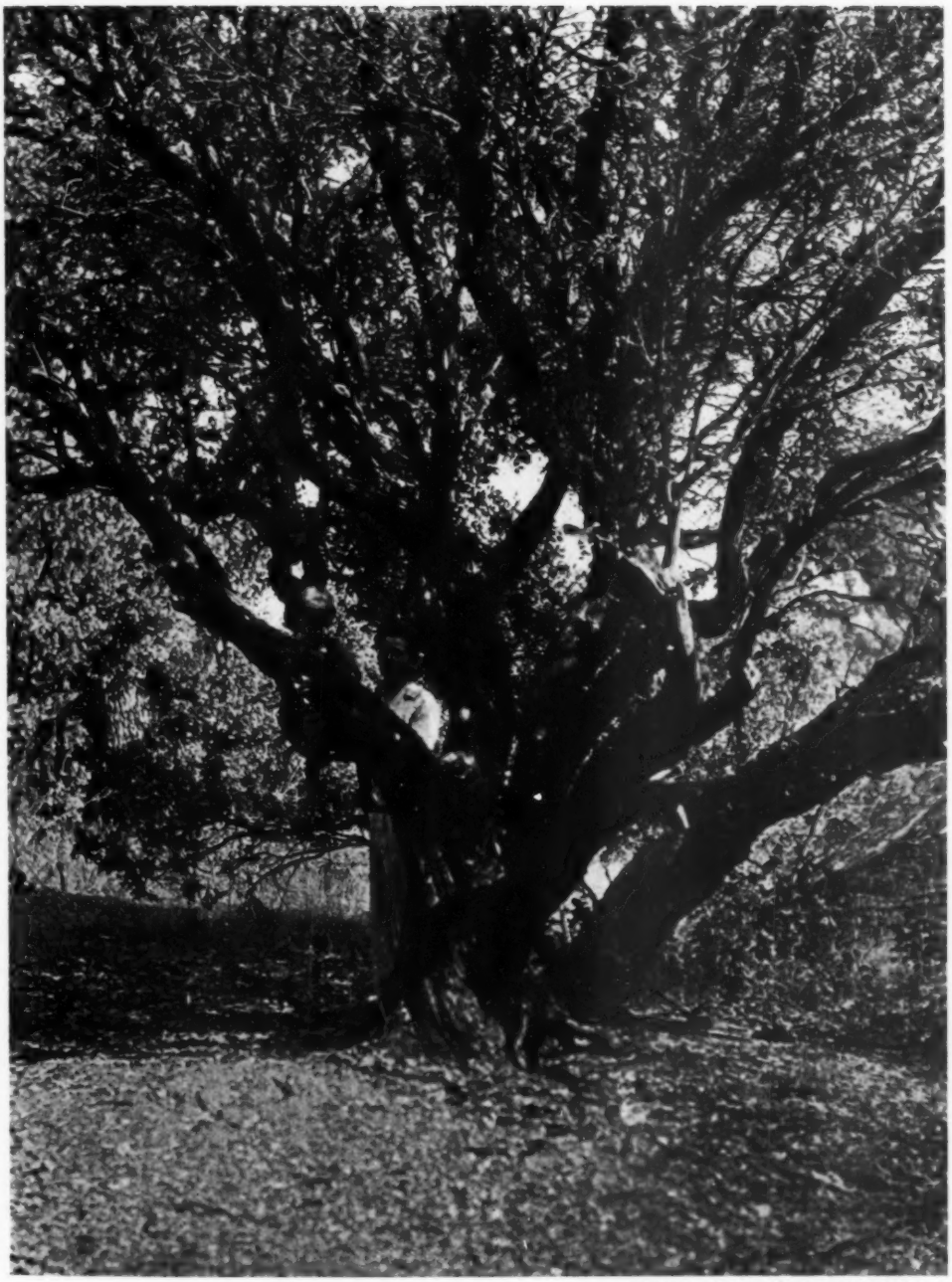
[1] Among the other genera of rather widespread distribution are *Cercocarpus, Eriodictyon, Dendromecon, Xylothermia, Lonicera, Lupinus, Diplacus, Chrysoma, Hosackia, Baccharis, Garrya, Rhus, Ramona,* and *Sphacele.*

[2] Particularly on the ranches of R. S. Rodman and Dr. W. Barclay Stephens.

Photographs by C. Hart Merriam

The light green of the low manzanita forest on the edge of the clearing contrasts with the background of black oaks

One of the largest Clear Lake manzanitas; it has a spread of nearly forty feet



Photograph by Dr. W. B. Stephens

A GIANT MANZANITA

On the flat ground on the west side of Clear Lake, near its junction with Upper Lake, manzanitas form veritable forests averaging twenty-five feet in height and with trunks often attaining a thickness of upward of two feet

branches and foliage? Be this as it may, they always stimulate the imagination, giving rise to feelings one does not experience elsewhere. And as they differ widely in geographic position, climatic surroundings, and component species, so they invite different emotions and call up different thoughts. Thus the groves of dwarf live oaks on the steep wind-swept slopes of some of the coast ranges of California, and the low forests of mountain buckeye on Roan Mountain in Tennessee and North Carolina, both bathed in driving fogs and heavily draped with lichens, present weird fantastic shapes that appeal strongly to the imagination; the timber line tongues of dwarf whitebark pines and alpine hemlocks that clothe the upper reaches of many of the higher mountains of the West, produce a sense of exhilaration and rugged vigor; the stunted forests of piñon, juniper, and mountain mahogany of the elevated borders of some of our western deserts prompt many a traveler to seek them for the night's camping place; while in the warm balmy atmosphere of the beautiful valley of Clear Lake, the manzanita forests have a peculiar charm, their glowing red trunks, light overhead foliage, and rich carpet of dark red berries creating a warmth and depth of color and a feeling of quiet restfulness that tempt one to return again and again.

Photograph by C. Hart Merriam

Two species of manzanita (*A. canescens* and *A. stanfordiana*) against a sparsely wooded hill slope in the mountains north of Clear Lake

"Back to Nature" Scientifically as Well as Emotionally

THE CASE FOR MORE FIELD WORK IN BIOLOGY[1]

By W M. E. RITTER

Director of Scripps Institution for Biological Research of the University of California

I WISH to set before you some of the grounds of my conviction that the future's progress in the biological sciences will be accomplished by a far closer, more vital interdependence between researches out in nature and researches in the laboratory; between data gathered in the field and those secured in the laboratory either by observation alone or by observation coupled with experimentation. The "natural history mode of philosophizing" will have to be taken far more seriously, I am persuaded, in years soon to come, than it is now.[2]

Laboratory learning when uncoupled with field work is very defective in the development of the powers of observation. For example, laboratory teaching rarely if ever even pretends to make use of the sense of hearing for acquiring an understanding of animals. Yet the whole province of sound presented by numerous mammals, most birds, and many insects is open to cultivation and contains much that is highly educative and pleasure-yielding, and, furthermore, is the vestibule to biological problems of great interest.

Again the sense of smell, so well-nigh completely neglected as an avenue through which knowledge of plants and animals may be obtained, is in reality full of possibilities for penetrating into some of the most recondite provinces of life phenomena. For instance, our noses brought systematically to bear on the odors of flowers would constitute a method of qualitative chemical analysis, as one might call it, for determining some aspects of the chemistry of plants the delicacy of which cannot be approached by ordinary chemistry. Chemical natural history ought to and undoubtedly will sooner or later address itself seriously to odors in both zoölogy and botany, for it is an open and beckoning door to the fundamental problem of chemical distinctions of species. Considerable attention to the matter has convinced me that very many blossoms usually accounted odorless are not really so, and that in the greater number of cases each species is distinguishable from every other by its odor. Something of the meaning of this as touching species differentiation in chemical substances and processes is readily perceived when one remembers that according to present views the sense of smell is a chemical sense, responding to chemical stimuli.

Even the cultivation of the sense of sight, depended upon virtually alone in laboratory observation, is exceedingly lopsided. Alertness of sight is encouraged hardly at all. The complete passivity of the anatomical preparation fosters deliberateness and slowness and inclines toward sluggishness and finally dullness of seeing; nor is the set-up and controlled physiological experiment much if any better in this respect.

How different the attitude of the lab-

[2] Having taken a leading part in bringing into existence two biological laboratories, one at Berkeley, a teaching laboratory primarily, another at La Jolla, a research laboratory primarily, I hardly can be charged with inexperience of the methods and scope and possibilities of such laboratories either as instruments of research or of teaching. I yield to no one in appreciation of laboratory work, not only for the magnificent things already accomplished by it, but for the greater things yet to be accomplished by the same means. But in the face of this, I express, very deliberately, the conviction that exclusive reliance on laboratory and experimental methods has gone so far in biology as to work great harm to the biological thought of our day, not alone among professional biologists, but also on the part of the general public.

[1] Extracts from an address given before the California Academy of Sciences, San Francisco

oratory student and that of the field student occupied with, let us say, the breeding habits of any one of the many species of birds which can be studied only in nature! The field student, in the midst of a complex of phenomena which he has not set up, and cannot control in any degree, is under the necessity of being ready all the time to catch whatever particular element in the complex may turn up at any instant. Readiness and quickness and sensitiveness are observational qualities of primary importance for him while they are of little importance to the laboratory student.

Nor is the defectiveness in laboratory training as compared with field training restricted to the sensory side of the knowledge-getting process. Students trained exclusively in the laboratory face nature in the open not only with ears and eyes unpracticed and dulled, but with minds and imaginations similarly impaired.

But the lopsided result from the exclusively laboratory method comes also from the sole reliance on what is known as the "type method" in botanical, zoölogical, and physiological instruction. Elementary instruction in zoölogy too often encourages the conception that the animal types studied in the laboratory, namely, amœba, paramœcium, hydra, starfish, earthworm, crayfish, shark, frog, pigeon, and rabbit—traditions in laboratory instruction—are fundamental, and that all else is more or less incidental and of secondary importance; as though the foundation of a mansion were so solid and durable and important as to make a superstructure unnecessary. The actual animal world consists of individual living animals first, foremost, and always; and any scheme of instruction which does not take due cognizance of this fact leads inevitably to conceptions of that world which are narrow, distorted, and predominantly false. . . .

Using the building figure, the point to be decided is: given a small amount of money to be expended on a dwelling, which would be better, to spend it on a good basement even though there should be no funds for erecting the superstructure; or to build as much of a house as possible with the money available, although both foundation and superstructure must be small and cheap? Education in the biological sciences has been largely a process of digging cellars, walling them in strongly, and then living in them.

The biology which we have been calling foundational but which more truly would be called basement or cellar biology, has served the ends of sanitation, medicine, agriculture, and other physical interests well, and to this extent has been very useful and noble. But as superstructural biology, as biology for the liberal education of our young people, for the enlargement of their outlook upon life, particularly upon human life, it has achieved only a dismally small measure of the success possible to it. But there is a way out, as I see it, from our unfortunate condition; and institutions of the type of this one,[1] it appears to me, are likely to play a large part in the renovation of this province of natural knowledge.

Let me call your attention to an almost unbelievable thing which has happened during what may well be called biology's period of laboratory incarceration. A large number of biologists have actually held the view, apparently with sincerity, that nothing of primary importance about organic nature can be learned except in the laboratory and by experimentation. The old anthropocentrism which conceived everything outside of man to have been created for his especial benefit, has been replaced by a new anthropocentrism according to which man would subject all nature to his control. . . . What makes this particularly amazing has been the fail-

[1] Museum of the California Academy of Sciences, San Francisco, California.

ure to see its implications as touching the other descriptive sciences. That living nature is in essentially the same case with geology, and physical geography, and meteorology is obvious. Where would these sciences be today had their leading investigators depreciated field work and insisted that the method of inference based on laboratory experiments would yield all the understanding needed for strictly scientific purposes about the earth and the atmosphere? . . .

There have been counteracting influences fortunately in such undertakings as the great oceanic and continental exploring expeditions and the "surveys" prosecuted by our national and state governments. Probably the most potent compensatory influence in our country has been the work in agriculture carried on by the nation and the several states. The vast importance of this for the material welfare of the people is sufficiently recognized; but its importance to biological science *as such* is understood not half well enough. What I wish to bring out particularly does not concern the enrichment of botanical and zoölogical knowledge, greatly important as I regard this, but rather the enlarging and liberalizing influence on the public mind generally. It seems to me probable that the total educative value in natural science of the national and state agricultural departments, including the experiment stations and the agricultural colleges, is greater than that of all other school and university effort combined.

I can do no more than refer in the briefest way to the larger, the philosophic effect of the influence of agricultural enlightenment on man's understanding of his own dependence upon nature. Innumerable peoples in all ages and countries prior to the development of agriculture *as science* have conceived the organic products with which their lives have been inseparably identified to be dependent upon supernatural or unnatural agencies of one kind and another. The transformation that has taken place and is taking place (for it is far from complete) in ideas and beliefs because of the demonstrations of nature's ways and laws here is of truly enormous importance. It touches vitally the whole gamut of human life, esthetic, philosophic, and religious, no less than hygienic, economic, sociologic, and political.

And consider a trifle more fully another aspect of the same matter; that, namely, of the problem of overpopulation. With advance in civilization, entailing as it must man's ever-growing reflectiveness on the conditions of his race's continued existence and progress on this earth, questions of the competency of the lands and the waters to support the ever-increasing populations inevitably press more and more upon him. Now, beyond all question, of all agencies which may be invoked against this cloud on our mental horizon the most potent is scientific agriculture. Civilization seems to carry with it the termination of its own progress unless science be invoked speedily against this result. . . .

Remedial measures all along the line —philosophical, investigational, and educational—are demanded. My efforts toward building a research institution for studying nature with all the rigor of modern methods instead of with only such fragments of it as can be brought into the laboratory, testify to the great importance I attach to the first and second of these. In the third we are confronted with very difficult questions, especially in elementary education. . . .

The difficulties, however, are not insurmountable. The main thing for a beginning is a conviction of the importance of what is aimed at. Let the leaders in biological thought and research once become convinced that field work is as fundamental to life-science as a whole as similar work in geology and the other sciences of the earth is to

earth-science as a whole, and the proper training of investigators will come about promptly and with no great difficulty.

The relation of floras and faunas to latitude, and to elevation above sea level on land and depth below it in the ocean, presents as fundamental problems to biology as stratification and the topographic character of a region present to geology, and it is as absurd to think of solving the one class of problems as the other by laboratory experiment, prosecuted without any serious study of the phenomena themselves. Geologists would not be recognized as geologists at all if they had received no other than laboratory training, while training in the laboratory is held to be all that botanists and zoölogists need. . . .

Let the molders of public opinion in the chief subjects usually called humanistic—history, sociology, economics, politics, ethics, religion, once come to see how fundamentally soundness of view and healthfulness of life in all these domains are dependent upon correct elementary information about nature, and innumerable students of educational problems, teachers, and public-spirited and philanthropic persons will concentrate their thought and ingenuity upon surmounting the practical difficulties in the way of securing the contact with nature which is indispensable to such information and attitude.

The only specific expression as to procedure which I now make is such as concerns the part which it seems to me institutions like this ought to play in the educational reformation demanded by the times. The greatly extended elementary education in living nature which it is to be hoped the future will see, will be accomplished through a judicious working together of parents, schools, botanical and zoological gardens, city parks, aquaria, and particularly endowed foundations, which, like this California Academy of Sciences, combine researches on the natural history aspects of biology with public museums. Underpinned by a clear perception on the part of a much larger proportion of scientific men themselves, of educators, and of leaders of opinion as to what it all means, such educational undertakings as those by the American Museum of Natural History in New York City[1] and the Field Museum of Natural History in Chicago have possibilities for good that are simply incalculable—and it is with the utmost satisfaction that I witness the splendid beginning in the same direction being made for San Francisco by the California Academy of Sciences.

[1] In connection with this paper by Dr. Ritter, we would recall that the American Museum has for many years conducted field expeditions on a large scale in this country and other countries, and bases the greater part of its laboratory researches directly upon its field researches. Also large educational work in connection with the secondary and high schools of New York City was begun by the American Museum a considerable number of years ago. This work has been further organized and expanded under the personal administration of Mr. George H. Sherwood into a most efficient system of lectures and class instruction at the Museum, and classroom study in the schools on loaned sets of birds and many other kinds of specimens. In addition, the Museum has had the policy of constructing permanent exhibits, like the bird and reptile groups, which show animals in their home environment, setting forth their life history, and their relations to food and enemies as in nature. Thus, for the schools of the congested parts of New York City, the American Museum has come to serve as both "laboratory" and "field." Institutions of this type have a great work before them for the future, in that they stand peculiarly and particularly as interpreters between the scientific workers of the country and the people.

That field work has not been always highly rated in the past is partly explained by the fact that biology is just coming out of the period when laboratory work was so exalted by its merit as a method that any other method was undervalued by contrast. This sort of thing is always to be expected because of the method of development of science. Growth of biological science, for instance, from the beginning through the centuries, has come about by the exploration step by step of a vast unknown province of knowledge. At any given moment in its history we should be certain to find that scientists are putting the emphasis unduly on some partial phase of the work or some temporary method. Progress, however, comes only by specialization: because of the briefness of any man's life, if he is to accomplish anything worth bequeathing to science, he must specialize, and leave to the men in the generations after him the task of fitting his contribution into its place in the developing body of knowledge. It is by these side branches of profoundly serious, accurate, although not fully comprehensive investigation that the main iine of advance is assured.

The point of Dr. Ritter's paper cannot be emphasized too often or too strongly,—that for the sake of knowledge, training, and liberalizing influence, increased amounts of field work should be combined with the classroom and laboratory work in all elementary courses for the study of plant and animal life.—THE EDITOR.

A Glimpse into the Quichua Country of Southern Bolivia

By LEO E. MILLER

Leader of the American Museum's South American Expedition, 1915–1916

THE boundaries of the Incan Empire had gradually been extended until within five hundred years after the arrival of Manco Capac and Mama Occlo, supposed Children of the Sun, it covered nearly one third of the South American continent. Near the middle of the sixteenth century, when Pizarro and his insatiable band invaded the sacred precincts of Atahualpa's dominion, the star of the Inca seemed to have reached the apex of its ascendancy. Under the beneficent rule of their venerated sovereign, the several tribes lived contentedly, if not always peacefully; agriculture thrived; arts and crafts were encouraged; and, responsive to the efforts of many thousands of laborers, numerous mines poured a constant stream of precious metals into the kingdom, adding to its wealth and splendor.

Quichuas of the large towns, who have come into contact with the Bolivians, no longer wear the original native costume (see page 412). Their highly varnished straw hats, for instance, are a radical change from the skin headgear of the highlands. They have not, however, lost their habits of thrift, and trudge along the roads spinning industriously

We are all familiar with accounts of the advanced state of civilization, governmental organization, and fabulous riches of the ancient nation. Temples, palaces, and forts —stately edifices of hewn stone— dotted the mountain-sides and crowned the eminences; beautifully constructed highways connected many of the remote districts with the capital; countless herds of llamas fed on the slopes, and streams of water, flowing through a system of aqueducts, poured into the heretofore arid wastes, and transformed them into fruitful fields capable of supporting a numerous population. The present-day republics of Ecuador, Peru, and Bolivia, as well as a part of Colombia and Chile, were included within the limits of the vast empire.

Suddenly a dark cloud appeared on the horizon and omens of evil import

presaged the downfall of all this greatness and splendor. The fatal apparition quickly assumed the form of bearded strangers, some of whom were mounted on terrible beasts which filled the ranks of the Indian warriors with panic, and who seemed to have succeeded in harnessing the lightning and thunder for the furtherance of their wicked designs. Suffice it to say that before the avarice of the Spaniards had been abated, eight million subjects of the Inca perished and the organization of the nation was destroyed. With the single exception of the Aztecs of Mexico, who were practically exterminated by the same people, there has never been another example of such rapid and complete devastation in the history of the world.

The Quichua of today is a cowed, almost pathetic individual; he has been kicked about by the descendants of the *conquistadores* until he has learned to become reconciled to his lot; but while it seems as if this resignation might, in many instances at least, give way to despair, such is not the case.

During the year 1916, the writer and his companion, Mr. Howarth S. Boyle, spent a number of months in the highlands of Bolivia; and while engaged, primarily, in zoölogical researches, it was impossible not to take cognizance of the Indians populating the higher valleys and table-lands.

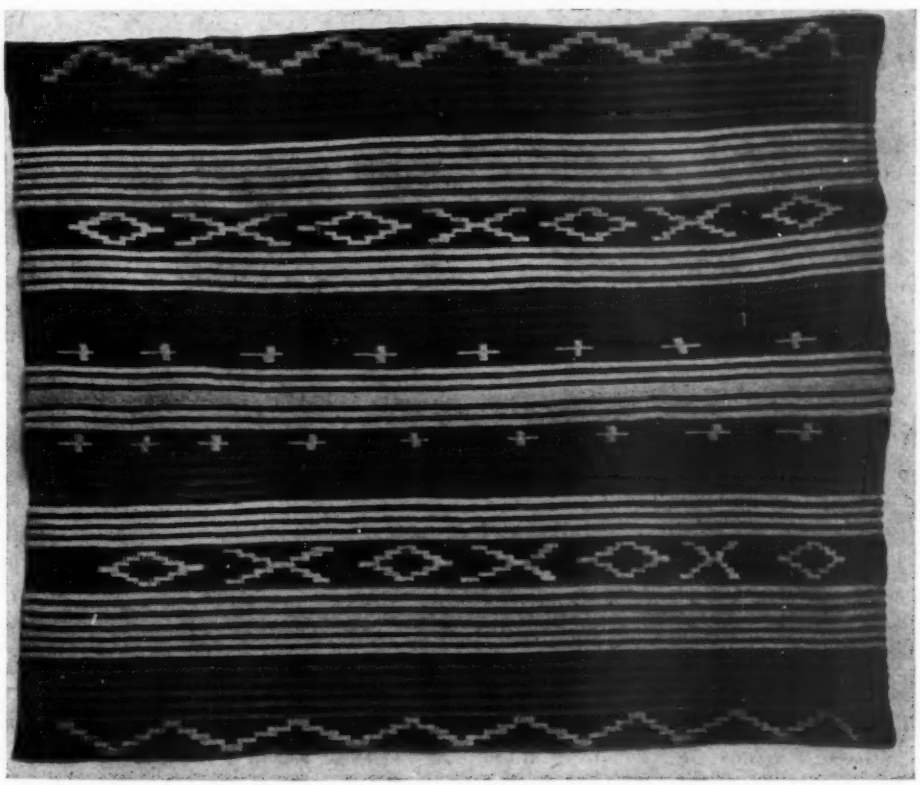
The high plateau of Bolivia is naturally arid; but the Quichuas are masters in the art of husbanding the scant supply of water coming from the melting snows of the high Andean peaks, and thus irrigate extensive areas for cultivation. In most instances the dwellings of the Indians are scattered about some distance apart in sheltered little valleys, and the fields lie on the slopes higher up; to these fields the men, and often the women also, go each day to work, while the children care for the flocks of sheep which nibble on the sparse vegetation growing in the waste places. The density of the population is surprising; the number of individuals to the square mile is greater than that in the hot, tropical lowlands.

Ignoring the fact that Indians comprise the larger part of the inhabitants of practically every Bolivian town and city, there are nevertheless many strictly Indian settlements, some of considerable size; these consist of rows of low houses crudely built of stones or of blocks of adobe; the roofs are of grass thatch, or, where this is not available, of a mixture of earth and chopped straw covered with pebbles. Little shops are scattered here and there, but usually the variety of articles offered for sale is small. *Chicha,* or corn beer, however, is to be had almost everywhere, and even after the traveler in this country is aware of the process of its manufacture, he is invariably glad to stop at some small wayside hut where a white rag fluttering from a tall pole announces to the passerby that the national refreshment is for sale within.

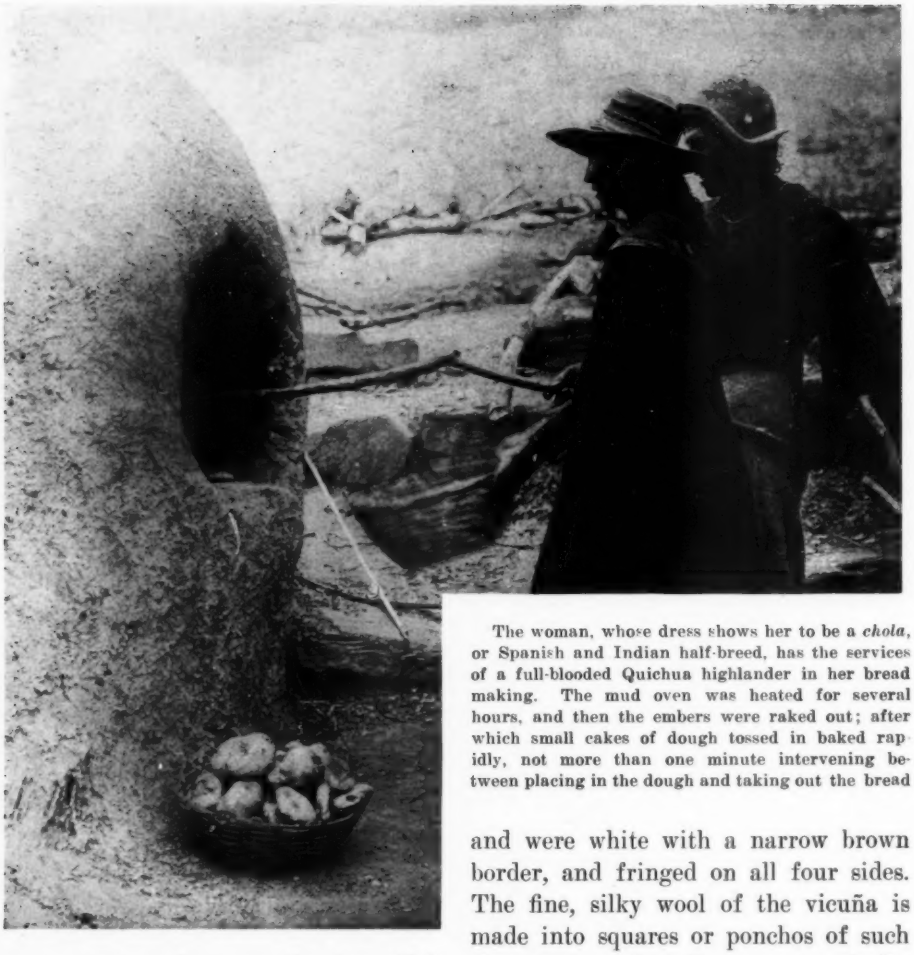
At least one day of each week is set aside as market day. The Indians then come from far and near, driving a few burros or llamas, or carrying packs on their backs. They bring beans, oats, potatoes, milk, cheese, and many other products; also apricots, strawberries, and flowers. Arrived at the place, each woman squats on the ground and spreads her wares out in front of her, waiting for customers. Apparently this is a most enjoyable procedure; for, if stopped on the way to market, she invariably refuses to sell anything, even though it might save her a long walk and relieve her of a heavy burden.

Among the things that appealed to

Quichua farmers raise sheep, cattle, and pigs instead of the llamas of olden times. They keep their cattle from straying by means of fences of mud, there being a great scarcity of timber



In the olden time when subjects of the Inca rulers were called together from widespread parts of the kingdom to enjoy a feast, they were expected to wear as a means of identification, blankets woven at their native place in a certain pattern and coloring. These patterns have persisted until the present, blankets of various localities differing widely from one another. This specimen (5 ft. 8 in. by 4 ft. 7 in.), from Cghilka near Sucre, is woven in green, red, orange, pink, and white



The woman, whose dress shows her to be a *chola*, or Spanish and Indian half-breed, has the services of a full-blooded Quichua highlander in her bread making. The mud oven was heated for several hours, and then the embers were raked out; after which small cakes of dough tossed in baked rapidly, not more than one minute intervening between placing in the dough and taking out the bread

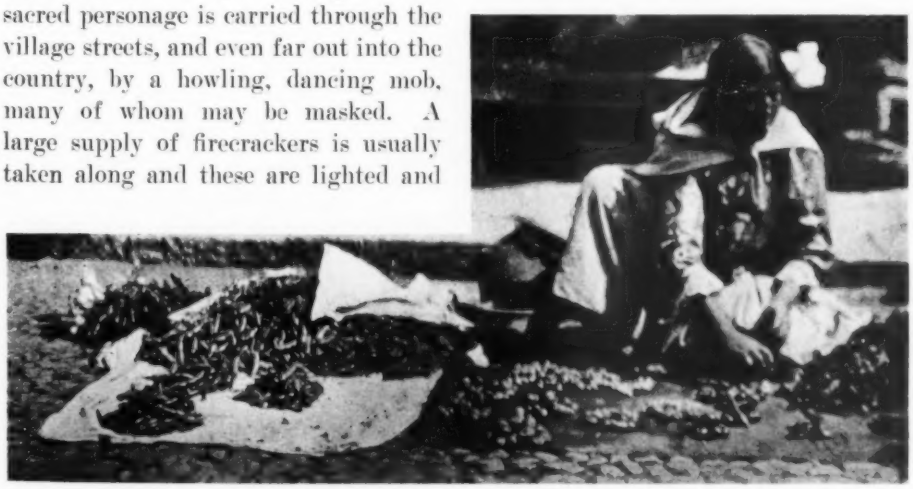
us most strongly were the beautiful blankets which were sometimes offered for sale. It seemed as if these differed in each locality, conforming perhaps to a custom of bygone days. The blankets we saw near Totora were of coarse weave, very heavy, and with wide stripes of subdued colors merging into each other and giving a pleasing rainbow effect. At Sucre the stripes were very narrow and of many brilliant colors, and in one restricted locality beautiful geometric designs added greatly to the attractiveness of the pattern. In the vicinity of La Quiaca on the Argentine frontier, most of the blankets were made of llama's wool, and were white with a narrow brown border, and fringed on all four sides. The fine, silky wool of the vicuña is made into squares or ponchos of such close texture that they are practically impermeable to rain; they are greatly esteemed by their owners, who will part with them only for an exorbitant sum.

When market day is over, and all the produce from the uplands has been sold, the greater part of the proceeds is spent for coca leaves from the lower country. The Indians then abandon themselves to a night of singing, dancing, and drinking. The song always begins in a very high key, and the shrill, penetrating voices of the women rise clear and piercing above the low drone of the men. There is only one tune, as far as I could discover, and an interminable number of verses are sung to

The vender of coca leaves squats close to her supply of the drug with her scales at hand, eyeing prospective customers and looking forward to the haggling that is sure to ensue. The Quichuas consume enormous quantities of this drug, and use vast areas in the cultivation of the plant

it. Upon reaching a certain point in each stanza, all the singers clap their hands in time with the music and keep it up until the end of the refrain.

The Quichuas enjoy few events so thoroughly as a religious festival. Should the celebration be in honor of some favorite saint, the image of the sacred personage is carried through the village streets, and even far out into the country, by a howling, dancing mob, many of whom may be masked. A large supply of firecrackers is usually taken along and these are lighted and thrown into the air to explode about the saint's head. We frequently met the fanatical processions on the otherwise deserted trails, and it was always difficult to prevent our entire pack train from bolting down the steep mountain-side, and to protect ourselves



A common market scene. The women squat on the ground, spread out their store of beans, potatoes, or other produce, in neat little piles of five centavos' worth apiece, and wait for customers. In weighing their wares, they use a balance with a small stone as a unit of measure

from the shower of rockets and exploding missiles. The band halts at each hovel for a drink of *chicha*, and then continues along the dusty way.

In the vicinity of Cochabamba the Quichuas are rather civilized, comparatively speaking, owing to their constant association with the Bolivians. As one goes farther toward the south, however, a marked change is noticeable. This reaches its climax in the regions bordering the Upper Pilcomayo.

Quichua woman from the Upper Pilcomayo, who daily carried goat's milk to the expedition's camp. The front of her loose dress is tucked up for the walk down the mountain. Her shawl is fastened with spoon-shaped pins, the only jewelry common in the Quichua country

On one of our excursions we left the expedition's base at Sucre, and following the Potosí road for a distance of thirty miles, made camp on the river bank. The bed of the Pilcomayo is several hundred feet wide at this point, and is spanned by a suspension bridge anchored at each end to picturesque towers. At the time of our visit the water was very low; the shallow, muddy stream, wending a sinuous course through the rock-strewn floor of the valley, was not more than fifty feet across. I could not fail to be impressed with the difference in character of the river in the upper and the lower stretches of its course. Here it was hemmed in by towering peaks of rock upon which such a light growth of vegetation obtains a foothold that it can support only a few flocks of goats, and these find great difficulty in eking out a bare existence; lower down, it sweeps through the steaming *pantanales* of the Gran Chaco, and finally enters the Paraguay almost opposite to the city of Asunción, a majestic, awe-inspiring river.

As frequently occurs in semi-arid country, birds were very abundant; but there was little else to indicate the close proximity of other forms of life, unless one took into account the herds of goats clambering about on the ledges and seeming to delight in bombarding every one who passed below with showers of small stones; or the caravans of burros and llamas passing along on the broad highway. A visit to the top of one of the neighboring mountains, however, revealed a different story. Patches of green dotted the

isolated little depressions to which the name "valleys" can hardly be given, and thin pillars of smoke ascended from them straight into the cloudless sky. After long and patient looking a small, stone hut set among rocks would invariably be discovered, and sometimes we could even distinguish minute, moving forms which we knew were Indians. There, tucked away between the towering peaks they love so well, they were living a life of peace and plenty, apparently unmolested, and caring little about the existence of the outer world. It was as if one tore a page from the history of bygone centuries, or found himself suddenly transferred into the midst of a contented, pastoral community such as must have existed throughout the vast empire before its despoliation by the gold-crazed invaders.

These Indians seldom come down into the lower country; their partiality for the high *puna* is well known—some of the ancient dwellings having been discovered at an elevation of more than seventeen thousand feet—and they are doubtless happier in their almost inaccessible fastnesses than if they lived nearer to their Bolivian neighbors.

In appearance and dress these Indians differ greatly from the other members of the tribe living in the more populous sections of the country. Instead of the more or less conventional attire adopted by the latter, they still adhere to a form of dress at least a part of which may date back to the days of Atahualpa. The women wear a quantity of clothing—short, full skirts of dark blue, and shawls of varied colors. The men are garbed in loose, white knee breeches, a gray or blue shirt, and belts which are neatly embroidered in gay colors and are very wide at the back so that they form a kind of sash; also they wear the inevitable poncho, a large square of heavy cloth with a hole in the center through which the head is thrust. Strange as it may seem, the small children always wear very long clothing, and the little girls waddling along in their full, almost

Quichua man from the Upper Pilcomayo, wearing a typical native costume: helmet-like hat of skin, blouse woven in a peculiar Indian pattern, wide loose trousers of coarse cloth, and sandals. His hair is braided in a long queue

trailing skirts resemble dwarfed, aged women. All the wearing apparel is made of woolen cloth of home manufacture. The men permit their hair to grow long and braid it in a queue which hangs down the back. Both sexes wear peculiar little hats made of some kind of skin prepared by a process which renders it very hard: these hats reminded us of steel helmets. With the exception of huge, spoon-shaped pins of copper, which the women used to fasten their shawls, we saw no ornaments of metal, nor jewelry of any kind.

The *piscomamchachi* is one of the official bird killers of the Quichuas. Armed with a sling, he spends the days in field and orchard, keeping up a continuous fusillade upon the birds which come to feed on fruit or grain. Posing for the camera was a new and mysterious experience for this lad

The home life of these Indians is tranquil and uneventful. Usually the little stone huts contain two or three rooms; potatoes and other produce are stored in one of them, and the rest are used for cooking and sleeping quarters. In very cold weather a fire is kept burning day and night and all the occupants of a house burrow into piles of sheep skins and blankets close to the smouldering embers.

We persuaded one of the women to bring goat's milk to camp each morning, but to do this we had the greatest difficulty. Only by payment for a week's supply in advance could she be induced to perform this service. From past experiences with his fellow countrymen, the Quichua has learned to regard all strangers with apprehension. On frequent occasions we had the opportunity of observing how the average *paisano* treats the Indian. Should night overtake him on the trail, he stops at the nearest hovel and demands food and shelter for himself and his animals. In the event that the owner has nothing to offer, he draws his rifle or revolver and shoots any fowls that may be running about, or lacking these, a sheep or goat, and seizes whatever else he can find. Should he see an attractive blanket, it is also taken. In the morning a few *centavos* are thrown on the ground and he continues on his journey.

As a rule we found that if the Indians were treated in a frank, honest manner, they were most amiable. The little woman we had engaged to bring us milk trudged down from the mountain-top daily in faithful compliance with her obligation. She brought cheese also, and occasionally a few eggs. As it gradually dawned upon her that

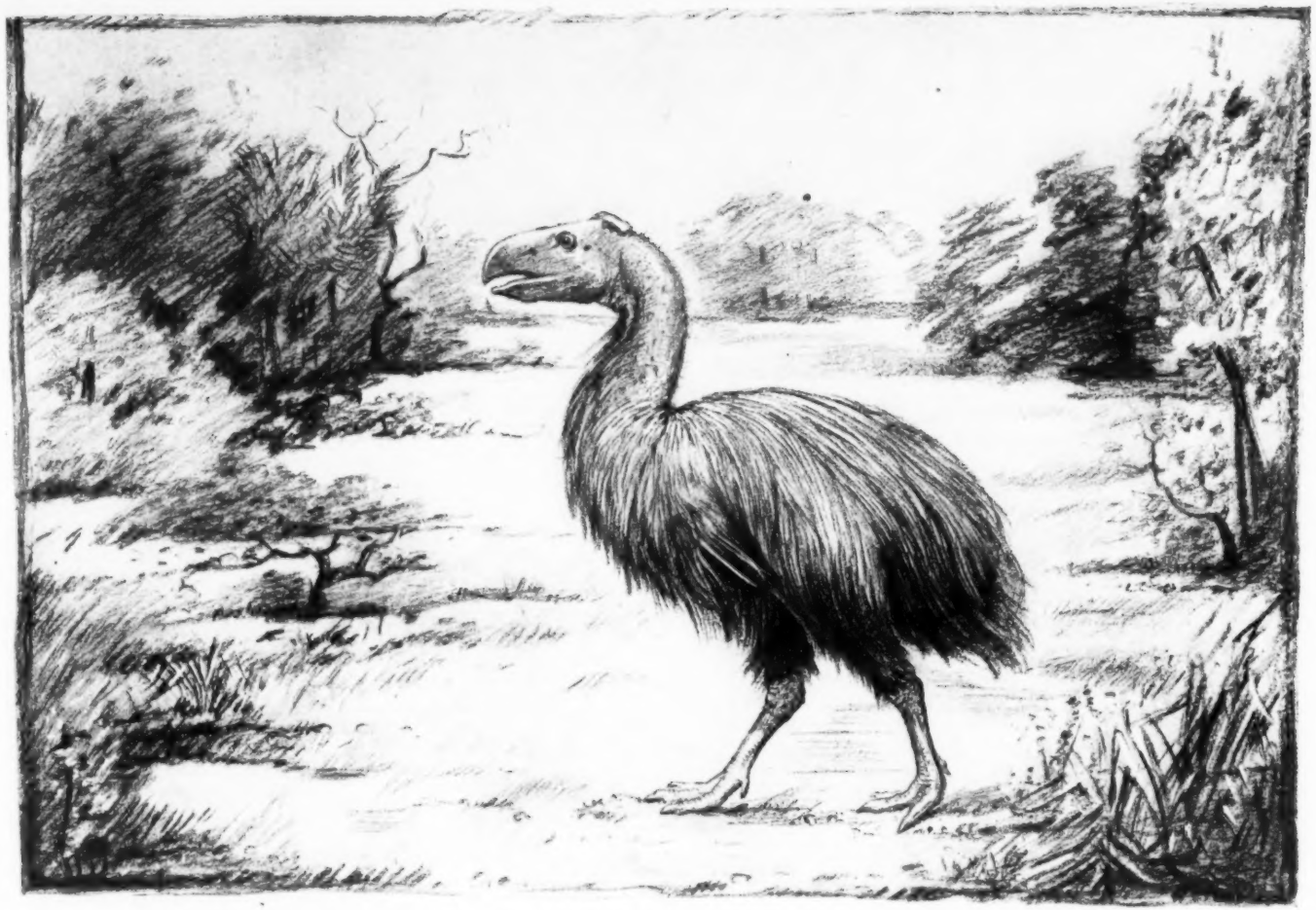
we were to be trusted, she became talkative and seemed to take an interest in our occupation. She spoke Quichua only, in common with the entire tribe, who make no attempt to learn Spanish; or if they are able to understand it, will make no effort to speak it.

Upon seeing a number of woodpeckers which we had collected, she expressed a great deal of satisfaction; for, according to the Indians' belief, if a pair of these birds makes a nest near one of their houses, a member of the family will die within a short time. The ovenbirds (*Furnarius*) are looked upon with favor and are encouraged to remain in the vicinity of the dwellings. Should a pair of the cheery singers place their huge, domed nest of mud near by, good fortune will follow in their wake; the abandoned nest is used in making poultices which are said to be a certain cure for a variety of ailments.

Any one guilty of robbing a bird's nest will, it is supposed, become violently ill; but as birds flock to the plantations in such great bands that an appreciable amount of damage is done to the fruit and ripening grain, their increase in numbers is discouraged by filling many nests with small stones. After the seeds have been planted, a network of strings is stretched across the fields, and a dead hawk suspended from a post in the center serves as a scarecrow to frighten away the marauding visitors. When the crops ripen, a small boy called the *piscomamchachi* is stationed in each plantation. He is armed with a sling and keeps up an incessant fusillade of stones; fortunately his aim is poor, but he succeeds in killing a few birds each day.

The Quichua of today leads a sedentary and pastoral life. His fields supply potatoes which are turned into *chuño* by simply allowing them to freeze and dry. From the wheat which he has learned to cultivate, a splendid quality of bread is made. His flocks provide flesh and milk, and the wool so essential to his well-being in the high altitudes; and the *tola* bushes and peaty growth known as *yareta* furnish an adequate supply of fuel. The demands of civilization, however, will alter his mode of existence until little will remain to remind us of the contented nation which at one time willingly bowed to the beneficent rule of the Children of the Sun.

Cases of scientific specimens on one stage of their long journey from Bolivia to the American Museum in New York. The three boxes weighed nearly two hundred pounds, but the Indian carried them without difficulty



EXTINCT GIANT BIRD OF WYOMING, CONTEMPORARY OF THE FOUR-TOED HORSE

Restoration of the *Diatryma*, the skeleton of which was the most important discovery made by field parties of the American Museum's department of vertebrate palæontology in the summer of 1916. This bird was much larger than an ostrich, although not so tall, with a huge head and very powerful beak. It was found in the Lower Eocene of Wyoming by Mr. William Stein. Restoration by Mr. Erwin S. Christman

A Giant Eocene Bird

By W. D. MATTHEW and WALTER GRANGER

IT is not often that a really important fossil discovery is due to sheer good luck. Generally speaking it is the result of a prolonged and arduous search in a formation which earlier reconnoissances had shown to promise good results. Sometimes it is found early in the campaign, more often after a long series of disappointments or partial successes that try the patience of the collector. Time and again he discovers fragments —teeth or jaws or parts of the skeleton—that buoy up his hopes and give warrant for his expectation that sooner or later a complete specimen will come to light if the exposures hold out and he sticks stubbornly to his search. Sometimes in the end his persistence remains unrewarded; at the close of the campaign he finds himself with but a poor return for diligent work, and must seek to retrieve his reputation in some other fossil field. Once in a while fortune befriends him, and he can place to his credit some new and splendid find which had, so to speak, no right to be there.

Such a discovery, to speak frankly, was the giant bird skeleton[1] found by Mr. William Stein last summer in the Bighorn Bad Lands of Wyoming. But let no one suppose that it was a find that anybody might have made. Only a trained fossil hunter would recognize such a find if he came across it, or having recognized would know how to explore and collect it properly. Mr. Stein is an able and expert fossil collector of many years' experience.

The Bighorn basin has been a well-known fossil region since 1881 when its riches were first discovered by Dr. J. L. Wortman, at that time collecting for the late Professor Cope. In 1891 Doctor Wortman headed a fossil hunting expedition to the basin for the American Museum, and again in 1896. In 1904 it was explored by the Amherst party under direction of Dr. F. B. Loomis. In 1910 Mr. Granger began a thorough and systematic exploration of the basin for the American Museum, and continued it for several successive seasons. Practically every exposure of the Eocene formations had been thoroughly gone over in this search, except for two or three small areas, and the Museum collections were enriched by over one thousand specimens important enough to catalogue and record individually, besides innumerable teeth and other fragments not catalogued. Practically all these fossils were mammals, the best of them being skulls and partial skeletons. By far the most abundant fossil is the *Eohippus* or four-toed horse, and of this the best specimen is the skeleton secured by Mr. Stein, which was fairly complete. Doctor Wortman in his early explorations secured two skeletons of the *Phenacodus* which are still the finest mammal skeletons that have ever been found there; and incomplete skeletons of several other interesting animals, *Oxyæna, Coryphodon, Pachyæna, Vassacyon,* etc., have been found. But on the whole, skeletons are rarities in the Bighorn fauna, more so than they are in the later Eocene formations, where fossils are usually better preserved.

Fossil birds moreover are exceedingly rare in our Eocene formations. Among the thousands of specimens secured by Mr. Granger's parties only a half dozen or so belonged to birds of any kind, and of these only two represented birds of gigantic size. One consisted of two toe bones, the other a fragment from the end of the metatarsus or "cannon bone." These were duly described by Dr. Robert W. Shufeldt and referred to the same genus as a couple of equally fragmentary remnants found in 1874 by Professor Cope in New Mexico, and named by him *Diatryma gigantea.*

In order to finish the work in the Bighorn basin, Mr. Stein was directed to search the small areas left unvisited, and spent about two months last summer in completing their exploration. He secured, as we expected, a fair collection of fossil mammals, which added something to our knowledge of certain

[1] The principal parts of the *Diatryma* skeleton have been temporarily arranged for exhibition in the case in front of the elevator on the fourth floor. It is intended later to exhibit the original specimen as a panel mount in the dinosaur hall, next the skeletons of *Hesperornis* and moa and other fossil birds. The skeleton was mostly disarticulated and scattered when found, and the bones are considerably distorted by crushing. It does not appear advisable to articulate the original specimen as an "open mount," but the bones can be cast and remodeled for this purpose.

powerful beak. It was found in the Lower Eocene of Wyoming by Mr. William Stein. Restoration by Mr. Erwin S. Christman

scarce species, and was in itself worth the expense of the expedition. But he was also so fortunate as to discover a practically complete skeleton of this giant bird, which previously had been known only from the fragments above mentioned.

The skeleton is of gigantic size, equaling all but the largest of the extinct moas of New Zealand, and much exceeding any modern bird in bulk. It is also of very extraordinary and striking proportions, with a huge head and massive neck, quite unlike any existing bird, and with an enormous high compressed beak. These proportions at once suggested that it was a relative or ancestor of those extinct giant birds of South America, *Phororhachos* and its allies, which it resembles in size and general proportions and especially in the great beak. A more careful study of the skeleton led to the conclusion that in spite of this very singular resemblance it was not a relative of *Phororhachos*, although perhaps of similar habits.

Reconstructed skeleton of *Diatryma steini*. The missing portions are dotted

The skull of *Diatryma* is about 17 inches long, the beak 6½ inches high and 9½ inches long. It is very short behind the beak, the back of the skull broad and adapted for powerful jaw and neck muscles, and the jaw also is very heavy and deep. The back part of the skull is much shorter relatively to the beak than in *Phororhachos*, and the beak does not have the strong down-curving tip; the jaw is much heavier and the whole construction shows a far more powerful bill.

The vertebræ are extremely massive and comparatively short, as one might expect from the size of the skull. The shoulder-girdle is very like that of a cassowary, and the wings were reduced in about the same proportion—more than in the ostrich or rhea, but not so much as in the moa, where there is no trace of them left. The body and hind limbs had much the same general proportions as in the moas, much bulkier but not materially higher in the back than a big modern ostrich, and on account of the short neck the head was not so high.

Our *Diatryma* must have been a truly magnificent bird—much bigger than an ostrich though not so tall, and more impressive because of the huge head and thick neck.

The discovery of this skeleton, practically complete and for an Eocene fossil unusually well preserved, is one of the few really important discoveries which have been made among fossil birds. Its exact relationships and the evidence that it affords as to the evolution and phylogeny of the birds, are discussed in an article in the May, 1917, Museum *Bulletin*. It does not appear to be closely related to any other known bird, living or extinct, but, like *Phororhachos*, it belongs to the Euornithes or modernized birds, and is not related to any of the great ground birds, living or extinct, although resembling them in body and legs. Its nearest living relative appears to be the seriema of South America, which in its turn is related to the cranes.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members, MESSRS. JAMES H. BARR and MOREAU DELANO.

Annual Members, MRS. AUGUSTINE J. WILSON, the REV. JAMES B. NIES, Ph.D., DR. H. R. HARDTMAYER and MESSRS. JAMES LANE ALLEN, LEROY V. ALLEN, T. B. DE VINNE, G. PAGENSTECHER, PHILIP B. RICE, CHAS. J. STEVENOT and EMIL WINTER.

DR. EDMUND O. HOVEY, curator of the department of geology and invertebrate palæontology, has returned to the American Museum after an absence of two years in the Arctic with the Crocker Land Expedition, which he joined in 1915. During his residence in the north Dr. Hovey carried on a valuable series of observations on the action of glaciers and the sea ice; on the physiography of the country, particularly of the region from Cape York to Etah; and on the geology of Parkersnow Bay and the vicinity of Cape Parry. Five months and two days were consumed in the return trip from Etah to New York City, although every possible means was used to hasten the journey. Delays were due wholly to weather and war conditions. Dr. Hovey arrived in this city on the same day that the "Neptune," commanded by Captain Robert A. Bartlett, reached Sidney, Nova Scotia, bringing the remainder of the exploring party and the collections from Etah. The four hundred boxes of specimens were forwarded by rail from Sidney to New York, where they are now in process of distribution in the American Museum. They comprise a rich series of zoölogical, botanical, ornithological, ethnological, and archæological specimens.

AT a meeting of the executive committee of the board of trustees of the American Museum held on June 20, Captain Robert A. Bartlett was made a life member of the American Museum of Natural History, in appreciation of his contributions to science through his Arctic work. Captain Bartlett has brought to a successful and speedy termination the hazardous voyage of the "Neptune," which was undertaken early in July as a third attempt to rescue the members of the Crocker Land Expedition, so long marooned at Etah.

EXCEPT for some prospecting work in a new section of the great quarry at Agate, Nebraska, no field expeditions were undertaken this summer by the department of vertebrate palæontology. In lieu of field work preparation and researches upon the collections were continued through the summer. A fine series of skeletons of duck-billed dinosaurs has been prepared and the specimens are being made ready for installation, to add to the exhibit of this group. Mr. Barnum Brown's recent explorations in the Cretaceous formations of Alberta and Montana have brought to light an unsuspected diversity of types among the dinosaurs belonging to this group. The common duck-billed dinosaur *Trachodon* had long been known to science, and is represented in our exhibits by the group of two skeletons and the "dinosaur mummy." Eight different genera of this group, very diverse in the shape of the skull, are represented in the skeletons and skulls now being prepared or already on exhibition.

A census of the skeletons of extinct animals in the Museum shows that there are at present on exhibition *ninety-three* original complete skeletons of fossil vertebrates exclusive of fish besides five casts of skeletons. There are in preparation or ready for mounting forty-six additional complete skeletons, besides others that have not yet been extracted from the matrix but are believed to be more or less complete. Of these 144 skeletons, 91 are extinct mammals, 40 are extinct reptiles, 10 are extinct birds, and 3 are amphibians.

MR. ROLLO BECK, who has been in charge of the Brewster-Sanford Expedition, has just returned from South America, where he has been collecting birds since the fall of 1912. Nearly eight thousand bird specimens were secured, including some rare species not previously collected. Among his many photographs, a series of the shearwater, a bird common off the coast of California and as far north as the Aleutian Islands, was taken near Cape Horn.

A NEW habitat group just placed on exhibition portrays a buck, a doe, and a fawn at

the edge of a clearing in the Adirondack forests. They stand in tall grass near a clump of alders, with a suggestion of woodlands beyond. A skillful adjustment of lighting gives the effect of fading sunset. The specimens of Virginia deer, used by the courtesy of Colonel Franklin Brandreth and Mr. Frederick Potter, were obtained by Mr. Roy C. Andrews on the preserve of these gentlemen in the Adirondacks. They were mounted by Mr. Walter Escherich. The foreground was planned and executed by Mr. Albert E. Butler, and the background, showing the locality where the animals were taken, was painted by Mr. Hobart Nichols after a sketch by Mr. Courtenay Brandreth. A description of the field work for this group was given by Mr. Andrews in the December JOURNAL, 1915. A photograph of a portion of the group is presented as the cover design for this issue of the JOURNAL.

SINCE the last issue of the JOURNAL several names have been added to the list of American Museum men in military service. The department of mammalogy and ornithology feels particularly crippled in the loss of five of its assistants, Messrs. H. E. Anthony, James P. Chapin, Ludlow Griscom, L. E. Miller, and Carlos D. Empie, all at present in the officers' training camp at Plattsburg. Mr. Russell S. Matthew awaits appointment after seven weeks of training. Mr. Howarth S. Boyle has already left for France in a Red Cross contingent, expecting to be assigned to some naval base hospital. Mr. Joseph S. McGarty is in the 71st Regiment of the National Guard.

PROFESSOR C-E. A. WINSLOW, curator of the department of public health, left New York for Russia on June 29 with the Billings Red Cross Commission. The headquarters of the Commission are at Moscow.

THE value to the country of the corn crop is being emphasized in the food exhibit in the foyer of the Museum by presenting scores of ways in which this chief of American cereals may be used in the home. The Corn Products Refining Company has presented to the Museum twenty-two products made from corn. Among these are various starches used for jellies, puddings, pie filling, and sauces; the syrups and sugars for confectionery, preserves, jams, and jellies; and the oils used for general cooking, pastry, and salads. Great quantities of gluten and oil cake, besides corn meal, are used for feeding cattle, thus indirectly contributing to our food supply. Aside from their food value, corn products have a large place in the arts and industries. From corn oil are made leather, rubber, paints, and varnishes; the starches are used for laundry purposes, for "sizes" in textile and paper industries, and for soaps and adhesives; the syrups and sugars are used in tanning, in shoe polishes, hair tonics, chewing tobacco, and in the manufacture of lactic acid and vinegar.

AN attractive addition to the food exhibit in the foyer of the Museum has been donated by Mr. M. J. Roth, of the Plastic Art Novelty and Specialty Company, New York, in the form of 74 models of 100-calorie portions of food. The models were made by Mr. Christian Jaeger.

A REVISED and popular edition of the handbook issued in connection with the Food and Health Exhibit has been brought out under the title *Health in War and Peace* and has been placed on the news stands for distribution at a nominal price. It is designed to acquaint the soldier, and also the general public, with all the proper precautions against the various causes of poor health.

AN addition to the handbook series of the American Museum is *Ancient Civilizations of Mexico and Central America*, by Herbert J. Spinden, assistant curator of anthropology. As stated in the preface, the book is intended as a general commentary on the history of the Indians of Mexico and Central America, and an explanation of the more important phases of their ancient life and arts. The book covers 238 pages and contains 44 plates and 222 text figures.

MR. RUSSELL J. COLES, who has recently returned from a ten weeks' motor boat cruise off the coast of North Carolina, spoke in the Board Room of the American Museum on September 1, before Colonel Theodore Roosevelt, Dr. F. S. Luther, president of Trinity College, Hartford, Conn., Dr. F. A. Lucas, director of the American Museum, and others interested in food conservation, on the

subject of the high nutritive value of sharks, rays, and other varieties of fish not hitherto consumed by man on account of long standing prejudice against them. Mr. Coles made exhaustive tests of the dietary uses of many kinds of fish during his cruise. He found in all eighteen species of sharks and rays which he pronounced delicious in flavor and very digestible. The average shark is not the scavenger and eater of human flesh that many believe it to be, but leads an exemplary life and is sometimes very fastidious in its choice of food, as in the case of the hammerhead shark, which subsists almost entirely on Spanish mackerel. Another variety follows the great schools of sting rays, which are themselves excellent food. The results of these experiments were sent to the United States Bureau of Fisheries, Washington, D. C., together with samples of the fish, both salted and fresh. Through a new process for tanning, the hide of sharks can now be made into leather, an important consideration in these days when the problem of shoes for our soldiers is becoming more serious.

THE first reports on the fishes of the American Museum Congo Expedition are now in proof. These include a systematic account of the fresh-water species, in which twenty-nine new forms are described and figured. Thirteen characteristic Congo fishes are illustrated in color from sketches made in the field by Mr. Chapin. It is seldom that life colors of fishes from remote regions can be shown so authoritatively, and both artist and engraver have contributed to make this one of the most attractive features of the reports. Some very interesting structures have been discovered in the skull of *Hydrocyon*. The tooth form of that genus seems to link it with Cretaceous fish-teeth, the relationship of which up to now has been a riddle. The rich material of the Congo fish collection offers fields for morphological and other studies as yet untouched. Fossil material from twelve hundred miles inland forms the basis of an interesting short paper.

To the collection of eggs in the bird hall of the American Museum has been added that of a gigantic ostrich (*Struthiolithus chersonensis*) of the Pleistocene period. This egg was found in the province of Honan, China, in June, 1915, by a Chinese peasant who saw it protruding from the bank of the Yellow River. The specimen is in perfect condition, the best of its kind in the world, there being but two other eggs of this fossil ostrich in existence. Of the great bird which laid the eggs not even a bone has ever been found. The shell has a capacity of more than two quarts, equal to about forty hen's eggs.

THE delicious small food fish, *Leiostomus xanthurus*, called "lafayette" near New York City, and which in occasional years like the present invades the harbors and rivers in such numbers that thousands of metropolis dwellers obtain pleasure in angling for it, belongs to the drum or weakfish family. Members of this family—among them the esteemed kingfish and big channel bass—frequent sandy shores, being especially plentiful southward, and almost without exception are good food fishes. They make grunting or croaking sounds, from which characteristic several have received their common names. Lying at anchor on a quiet evening in some southern bay, one at times hears the "wop," "wop" of a school of the big sea drum, as though they were calling to one another as they swim under the boat. The family has a single fresh-water species in the Mississippi Valley.

THE demand for the three series of public health charts illustrating "The Spread and Prevention of Communicable Disease," "Insects as Carriers of Disease," and "Bacteria and Their Work in the World," prepared by the departments of public health and public education of the American Museum, has been so great as to necessitate publication of a new edition in order to supply all the public schools of the city. The set consists of fifteen wall charts, made on heavy white paper backed by cloth and bound with tin at top and bottom. The charts are fully labeled, and in addition a booklet of information accompanies each set. These will be loaned to the schools of Greater New York without charge.

THE Nicaragua Expedition, in charge of Mr. W. DeW. Miller, assistant curator in the ornithological department, left New York February 18, arriving at Corinto on the Pacific coast of Nicaragua March 7. Mr. Ludlow Griscom accompanied the expedition as assistant. Mr. William B. Richardson, who

has lived in Nicaragua for twenty-five years, met the expedition at Corinto and remained with it throughout the trip. The various faunal regions of Nicaragua were visited, including the pine forest of the northern highlands, the tropical forest, and two volcanoes, Mombacho and El Viejo. A collection of 1170 bird skins was made. This adds about ninety species to the Nicaragua collections in the American Museum, received in former years from Mr. Richardson, and includes thirty species not heretofore recorded from Nicaragua. The American Museum now has the most complete collection of Nicaragua birds in the world.

MR. ROY C. ANDREWS reports to the American Museum that the Asiatic Zoölogical Expedition will return to New York about the end of September, bringing the largest collection of rare animals which has ever been assembled from China. Special features of the collections are the gorals and serows, strange mammals resembling the goat and the antelope. The expedition, of which Mr. Andrews is in charge, has been working in the province of Yunnan, China—in remote regions where no white man had ever been seen before the explorer and his party arrived. In Yunnan, two thousand miles have been covered on horseback and camps have been made in 107 different localities, varying from fifteen hundred to seventeen thousand feet elevation. Mrs. Andrews, who accompanied the expedition as the official photographer, has obtained natural color photographs, including views of the great gorge of the Yangtze River, which in some parts can be compared for grandeur with the Grand Cañon of North America.

DR. J. BEQUAERT has resumed his former work in the department of invertebrate zoölogy, after an absence of three months, during which he crossed the continent as a member of the Cornell Biological Expedition. This transcontinental tour was arranged by Prof. J. Chester Bradley of Cornell University, with the coöperation of Dr. A. H. Wright, for the purpose of collecting and studying the fauna and flora of the country. The expedition was unique inasmuch as it was the first attempt to use automobile transportation for a collecting trip on a large scale. The expedition left Ithaca, New York, May 24, and reached San Diego, California, August 14. More than six thousand miles were covered by the three cars and the two-wheel trailer of the expedition. The party included, at its maximum, thirteen members.

DR. HERMAN K. HAEBERLIN has been appointed assistant in anthropology in the American Museum. He holds at the same time a position in the department of anthropology of Columbia University and is to act as guide to the Museum for anthropological students at Columbia and Barnard. The appointment was made through a desire to bring about a closer coöperation between anthropological instruction in the two institutions and a wider use of the wealth of illustrative material in the American Museum.

THE initial number of the *International Journal of American Linguistics*, a quarterly edited by Franz Boas and Pliny Earle Goddard, appeared in July. This journal, which is of particular importance to students of linguistics, will be devoted to the study of American aboriginal languages.

A SERIES of lectures delivered by Dr. Robert H. Lowie for the department of anthropology of the American Museum during the early part of 1917 has been published in book form under the title *Culture and Ethnology*. The object of the work is to acquaint the layman with some of the results of modern ethnological work.

IN recognition of his gifts of moving picture films covering zoölogical subjects, Mr. Raymond L. Ditmars was elected by the board of trustees as a life member of the American Museum. Mr. George B. Hopkins was made a patron for his generous contribution to the building fund.

A COMPLETE revision of the lecture courses given under the direction of the department of public education of the American Museum is planned for this season. Instead of condensing the work into the short period of six weeks according to previous practice, lectures will be given twice a week through a period extending from the middle of October to the middle of January. On Mondays the subjects will be taken from geography and natural history, on Thursdays from

United States history. The geography and natural history course will include the following: Chief Cities and Countries of the World, 5 lectures; Natural History Stories, 4 lectures; Physical Geography and Astronomy, 3 lectures. Subjects for the United States history course will be: Discoverers of the New World, 2 lectures; Old and Modern New York, 4 lectures; Colonial History, 4 lectures; Current Events, 2 lectures.

Mr. Roy W. Miner, of the department of invertebrate zoölogy, spent the greater part of July and August in the marine biological laboratory at Woods Hole, Massachusetts, for the purpose of studying marine invertebrates with especial reference to procuring observations, sketches, and other data for the construction of a "sound bottom group," based upon the invertebrate fauna and sea flora of the bottom of Vineyard Sound, in the neighborhood of the Devil's Bridge, off Gay Head, Massachusetts. This is to be another unit in the series of window groups which are being installed in the Darwin hall. Mr. Miner was assisted in this work by Messrs. Shimotori, H. Mueller, and C. E. Olsen, as preparators.

A series of indoor and outdoor gatherings for the purpose of discussing the conservation of New York State's natural resources, particularly the vast forests of the Adirondacks, was held at the Lake Placid Club from September 4 to 8. This "forest week" was conducted under the auspices of the New York State Forestry Association, of which Mr. Herbert S. Carpenter is president, in coöperation with the State Conservation Commission, the New York State College of Forestry at Syracuse, the forestry department at Cornell University, and the Lake Placid Club. An interesting prelude to the business of the conference was an Indian council fire on the first evening, followed by "Indian Day" with speeches by Seneca and Iroquois Indians. The afternoon sessions of the conference were devoted to field trips to places of interest in the vicinity under the direction of well-known botanists, foresters, and geologists.

The American Museum War Relief Association in its Red Cross and Navy League branches has made a creditable showing for the three months ending August 31, as the display in Memorial Hall attests. During this period sewers and knitters turned out 245 separate pieces, consisting of 61 surgical shirts, 55 pairs of pajamas, 12 sweaters, 16 scarfs, and 23 pairs of wristlets. An appeal made to the men of the Museum by the Soldiers' Aid Committee brought a generous response from many, and with a portion of the funds thus secured three of the soldiers from the American Museum have been supplied with small outfits of useful articles. It is the wish of the Association to keep in touch with all of the American Museum men who have been called into military service and to supply them as far as possible with things they may need.

An important exhibit of human crania, with much information of value to students and those interested in anthropology, has been installed in the southwest wing of the Museum on the second floor, under the supervision of Mr. Louis R. Sullivan, assistant in somatology. This exhibit aims to point out some of the principal measurements and indices in which the various races of man differ from one another. The method of procedure for taking each measurement is indicated and the differences illustrated by typical skulls. One section is devoted to the descriptive features and elementary anatomy of the skull. Two charts introduced into the exhibit give a short history of craniometry and an explanation of the measuring points on the skull.

Mr. Harry Watkins, a member of the American Museum's recent zoölogical expedition in Peru, which, in coöperation with the National Geographic Society and Yale University, made a biological reconnaissance in the Urubamba Cañon, is continuing the work of this expedition in an attempt to discover whether the divide between the Titicacan and Amazonian drainage at La Raya exercises any influence on the distribution of bird life in that region. In prosecuting his researches from La Raya to Urubamba, he will complete the survey of the Urubamba region.

An American Museum exhibit of international fame is the series of horse skeletons mounted by Mr. S. H. Chubb and installed in the hall of the age of man. The series at present includes the skeletons of the draught

horse at rest and in motion, the full-grown Shetland pony grazing, the Arabian stallion on the alert, and the race horse in action, all of which show a spirit and vivacity resulting from the most painstaking and exact attention to all niceties in the mechanics of bodily movement. It is now proposed to make the series more complete by the addition of the skeleton of a trotter, the distinctive American type of fast horse. In this connection Mr. Chubb recently spent three weeks at Cuba, New York, on the estate of Mr. Frederick B. Simpson, making a large series of photographic studies of the motions of "McKinney," a well-known trotting horse, which has been presented to the Museum by Mr. Simpson.

IN 1904, the late Dr. Daniel Giraud Elliot published in the zoölogical series of the Field Museum of Chicago *A Check-List of the Mammals of the North American Continent, the West Indies, and the Neighboring Seas.* Shortly before his death in 1915, he prepared the manuscript for a supplement to this work, carrying the subject to about the end of the year 1914. This manuscript, submitted by his daughter, Miss Margaret H. Elliot, to the authorities of the American Museum of Natural History for publication, at her expense, has recently appeared as a Museum monograph, a volume of 192 pages, issued under the editorship of Dr. J. A. Allen.

A MONOGRAPH of 215 pages recently issued by the American Museum contains a bibliography of the scientific publications of Dr. Joel Asaph Allen. A photogravure frontispiece shows Dr. Allen as he appeared in 1885, the year in which he became associated with the Museum. The first forty-three pages of the volume are devoted to brief autobiographical remarks: the story of his boyhood days, with interesting personal experiences leading up to his life work, followed with descriptions of collecting trips taken in the period from 1865 to 1873, embracing expeditions to Brazil with Agassiz in 1865, to the Middle West in 1867, to eastern Florida in 1868, to the Great Plains and Rocky Mountains in 1871, and to the Yellowstone in 1873. The extensive bibliography which occupies the rest of the volume shows the results of his researches to have been published under 1453 titles covering: mammals, 271; birds, 966; reptiles, 5; zoögeography, 22; nomenclature, 35; biography, 134; miscellaneous, 20.

THROUGH the generosity of Mr. Ogden Mills, the Library of the Museum has been enabled to purchase additional monographs by John Gould needed for the completion of the series. The volumes included in the purchase are: *A Monograph of the Macropodidæ, or Family of Kangaroos,* 1841–2; *Supplement to the Monograph of the Trochilidæ; The Birds of Asia,* in seven volumes, 1850–83; *Mammals of Australia,* in three volumes, 1845–63; *A Century of Birds from the Himalaya Mountains,* 1832; and *A Monograph of the Pittidæ,* 1880–81. The volumes are handsomely illustrated with many hand-colored plates. They form a valuable addition to the resources of the Library, inasmuch as they are now exceedingly rare.

A REMARKABLE mummy, which was discovered in 1903 in an ancient cliff dwelling in the Tularosa Mountains of western New Mexico, has recently come into the possession of the department of anthropology of the American Museum, presented by Dr. S. M. Strong, now of the Medical Corps of the United States Army at Atlanta, Georgia. The cliff dwelling from which the mummy was taken was situated in a cave some two hundred feet above the bed of a cañon. The finder dug down into this cave to a depth of about nine feet, through six feet of loose débris above three different house floors, denoting successive periods of occupation. Under the third floor he came upon the body, which was in almost perfect condition, lying with head to the east and hands crossed upon the breast, the thighs bent upon the abdomen and the legs flexed. The mummy was wrapped in three blankets woven of rabbit skins, and beside it were thirteen pieces of decorated pottery, some stone axes, spear and arrow heads, and a gourd containing a handful of parched corn. In one hand the mummy held a stone pipe and in the other a tobacco pouch, while on the wrists were bracelets of bone and shell. An earthen pot had been inverted over the head, which is covered with reddish brown hair about eleven inches long. The fur blankets are said to illustrate one of the very oldest known forms of weaving.